CRAIoT : Concept, Review and Application(s) of IoT

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***Abstract*—IoT is a fast evolving concept. In IoT the message need to be delivered instantly between neighboring nodes in IoT enabled network and for this to happen the nodes need to be in overlapping transmission range of each other. Literature Survey reveals that not much work has been done in the direction of understanding the concept of IoT and exploring it's applications. In our proposed research work, effort has been made to explore the new and innovative application of IoT along with a detailed systematic literature survey.**

I. Introduction

To began with, the primary idea of the Internet of things is to interconnect multiple analog and digital electronic devices, either homogeneous and heterogeneous in nature but with in their overlapping transmission range of each other, so that they can efficiently communicate the information. IoT is a growing field and it would continue to grow exponentially in the years to come. Some of the places where IoT finds it's utility and purpose are detailed as follows :-

A. Applications of IoT

- For Instance if the user is watching a television in living room and the sensors installed with in the refrigerator detect that their is a need to refill the water bottles in the refrigerator because the water level is touching down the threshold value, then the sensor installed in the refrigerator would generate the broadcast 'Search' message to all the sensors installed in the house be it in the living room, lobby, drawing room or dining room to 'find' out where the person is so that the information can be conveyed to him, and he can proceed towards refrigerator to refill the water bottle. As all these sensors are closeby with in the overlapping transmission range of 8-10 meter each other so they are freely able to communicate with each other and share the message amongst themselves.

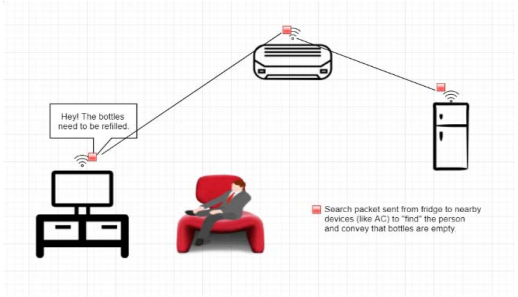

Fig. 1. Smart Home Application

- IoT can be of tremendous use for solving the problems of the physically challenged or specially challenged persons in their the day to day life. New IoT based Web Accessible application can be designed while adhering to the policies of the Department of Empowerment of Persons with Disabilities (DEPwD) [Ministry of Social Justice and Empowerment] which has started Accessible India Campaign (Sugamya Bharat Abhiyan), a cross country campaign to achieve global accessibility for Physically Challenged and for Persons with Disabilities (PwDs).

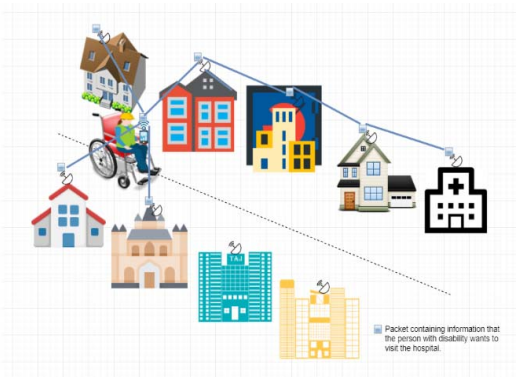

Fig. 2. Pictorial Representation of Application of IoT for Physically Challenged Persons

- Agriculture is the backbone of the developing country like India. The Failure/Successful growth of agriculture yields of crop can turn the fortunes of farmer(s) as it would help him to fetch more revenue for his agricultural produce but it would also boast the GDP of the country. Outreach of IoT can definitely influence the life of the farmer as by deployment of the sensor nodes deep inside the soil, can help the farmers to plan the month and time of the year when to sow the seeds, keep the growing sapling healthy by keeping it free of diseases by the usage of the right quality and quantity of insecticides, appropriate and timely delivery of water into the soil so that yield of the crop is high and farmers can reap rich reward of his produce.

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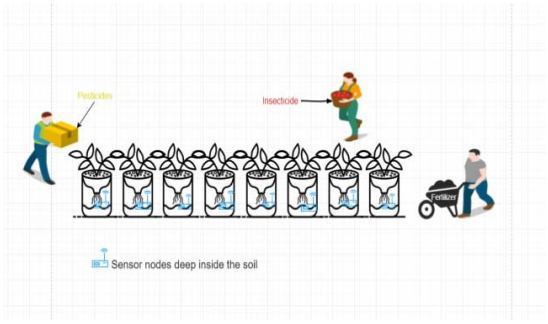

Fig. 3. Pictorial Representation of IoT in Agriculture

- IoT can play a very decisive role in predicting the occurrence of natural calamities like:- Earthquake, Tsunami, Flash floods, Thunderstorm, Hail storm, Incessant Rains, High Speed Wind/Tide so that the timely evacuation of the people can be done from the affected area(s) where natural calamities is likely to struck in future. The deployment of the sensor nodes in the affected areas and the inter and intra communication between the SHIP(Small, Partitioned, Intermittent and Partitioned) cluster oriented network of IoT compliant nodes helps in the quick dissemination of the nodes to the secluded and cut off regions struck by the disaster so that the relief operation can be begin as fast as possible and people can be rescued at the earliest and relocated to safe places.

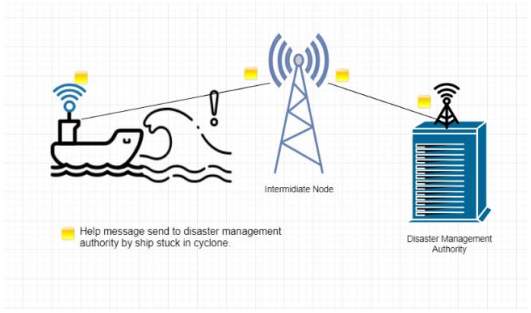

Fig. 4. Pictorial Representation of usage of IoT in Natural Calamities

- In the Urban scenario the medical care facilities can easily be provided to the people,be it rich or poor but to provide medical and healthcare facilities to the needy and underprivileged people in the mountainous terrain is a difficult task. As well known, the mountainous region is uneven, rocky and difficult to walk and navigate. The absence of good quality motorable road further compounds the problems as it becomes difficult to provide medical aid to the needy patients in the hour of crisis. If the crisis is due to the occurrence of any natural calamity the problems is multiplied exponentially as the regions might have suffere flash floods and frequent landslides with a result road gets cutoff and the ambulance may not be able reach to the remote villages and town in the mountainous region. The IoT is apt for such kind of scenarios as in the entire area is covered with senor based hardware node(Radio module) which can be used to sense the prevailing conditions in the affected area and the villagers can use these nodes to send the Alert or SOS messages to the relief and rescue teams so that the team of medical doctors and paramedics staff can be send to provide medical facilities to the affected people.

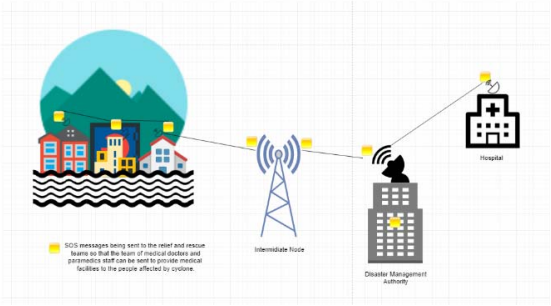

Fig. 5. Pictorial Representation of IoT in E-HealthCare /E-Medical Care

II. Literature Survey

In [1] the author talk about the increase in the growth of IoT from Web1.0 to Web 3.0. The future vision and expansion of the IoT together with it's cloud implementation on ANEKA platform has been discussed and demonstrated by the author. In [2] author(s) presents five IoT framework which are important in the installation and deployment of IoT-based E-products and discuss about various IoT categories for those applications that are commonly used to enrich customer satisfaction. In [3], author(s) have demonstrated an implementation of IoT for observing domestic conditions by use of ubiquitous sensing system. The details about the INA and the intercoupled mechanisms for the accurate monitoring of attributes by sensors and flow of data via network has been presented by the author(s). In [4] author(s) have presented an IOT Gateway system network based on Zigbee and GPRS protocols for the various scenarios taking into account industry need and requirements both from service providers and telecom operators. Their system presented the data transmission between WSN and Cellular and mobile communication networks, protocol mapping and conversion of different WSN protocols, and control functionalities for sensor networks. In [5] author(s) have written a survey paper that presents the challenges and opportunities of fog computing, focusing mainly in the networking context of IoT.Today, Fog covers both wireless scenario's like : mobile and the wireline network scenarios, traversing across both hardware and software, stays not only on network edge but also over access networks and among end users. As an architecture, all applications, including those in the Internet of Things (IoT), 4G and 5G wireless systems are ably supported by it. In [6] author(s) comments that developments in cloud computing and IoT have provided a great opportunity to resolve the problems caused by the ever increasing transportation issues. The author(s) proposes a novel vehicular data cloud platform that uses cloud computing and IoT technologies. In [7] author(s) describes that radio frequency identification system (RFID) helps the nodes be it device to identify objects, inspect metadata and control individual target through various radio waves. The author(s) comments that when the RFID reader is connected to the terminal of Internet, the readers can identify, track and monitor the objects attached with tags globally, automatically, and in real time, if needed, in what is the so-called Internet of Things (IoT). As per the author the RFID is widely seen as a prerequisite for the IoT. The author introduces the technologies of RFID and IoT, elaborates the roles, applications and challenges of RFID technology used

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in IoT. In [8] author(s) comments that Ubiquitous smart environments, possessing WSNs and MANETs, have thrown open open new opportunities in urban informatics. It is true that, Mobile Adhoc Network and Wireless Sensor Network convergence lays down the path for the development of IoT communication and network platforms with a high potential for a multiple applications in variety of domains. The experimental results showcases the feasibility and effectiveness of the proposed solution. In [9] author(s) describes the design, development and deployment of the IoT experimentation facility at a well known metropolitan city. The author(s) shows the deployment of the network architecture as large-scale IoT testbed being carried out at the main location in a city called Santander city. Also, solutions considered for implementation of the different components discussing the testbed functionalities have been chalked out. In [13] author(s) has discussed how capabilities of new technologies offer exponentially expanding opportunities for connected products and redefine their functionality and reshaping the industry. The author(s) also discusses various case studies to examine the effect of smart, connected products on industry structure and boundaries and also the new strategic choices facing companies. The author(s) examines value chain impacts and organizational issues. In [14] author(s) has presented a survey of various Internet of Things oriented architectures that are capable enough to improve the understanding of related tool, technology, and methodology to facilitate developer's requirements and summarized the current state-of-the-art of Internet of Things architectures in various domains systematically. In [15] author(s) explains how physical things connected to the internet, by utilizing data from multiple sources can provide synergistic services that go beyond the services that can be provided by an isolated embedded system. In [16] author(s) has highlighted the momentum with which Internet of Things (IoT) is gaining popularity, growth and advancement. The author(s) has mentioned facts and estimated the future market value of IoT. In [17] author(s) has exchanged views on the need of handling with new security and privacy challenges in IoT and how a legal framework must be established to deal with the same. In [18] author(s) has evaluated device providers, application developers, end-users et. al on multiple parameters to highlight the deficiencies of present IoT solutions. The author(s) has also made recommendations based on the analysis so that future IoT ecosystems would be improved. In [19] author(s) has reported different visions of IoT and addressed major issues like identification and tracking technologies, wired and wireless sensor and actuator networks, enhanced communication protocols, and distributed intelligence for smart objects. In [20] author(s) has discussed design challenges of IoT and presented various ways to integrate WSNs (Wireless Sensor Networks) with Internet followed by a case study. In [21] author(s) has weighed upon the legal aspects of IoT and its need to ensure security of the structure as well as the privacy of its users. In [22] author(s) has demonstrated some dummy projects in IoT. In [23] author(s) has discussed the potential challenges in IoT and explained why terse, self classified messages, networking overhead isolated to a specialized tier of devices, and the publish/ subscribe relationships formed are the only way to fully distill the power of IoT. In [24] author(s) provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT. The author(s) has also presented technical solutions and best-practice guidelines adopted in deployment of an IoT island in Italy. In [25] author(s) explores how sustainable partnerships and cooperation strategies can be used to establish urban and regional innovation ecosystems for experimenting and validating future Internet-enabled services. In [26] author(s) has focused on the need of convergence of WSN (Wireless Sensor Network) and presented a Cloud centric vision for worldwide implementation of Internet of Things. In [27] author(s) has explained how integration of Big data and Internet of Things has the potential to improve livability, preservation, revitalization, and attainability of smart and connected communities. In [28] author(s) investigates how the nodes in the Internet of Things generate Big Data, how it is used to generate semantic signs and analyse the importance of using 'Big Data', the 'Internet of Things', and the 'Internet of Signs'. In [29] author(s) have weighed upon how integration of healthcare devices and mobile apps with tele-medicine and tele-health can improvise the productivity, cost and patient's experience. In [30] author(s) have emphasised the behavioral, organizational and business issues of IoT that are necessary for individuals, organizations, industry as well as society.In [31] author(s) describes the applications of IoT coupled with architectural design of IoT enabled HMIS [HealthCare Management Information System].

III. Conclusion and Future Work

The IoT is a ever growing field with vast opportunities and avenues in the years to come. In the current paper different application where IoT is currently being used or can be used in future has been showcased. However their are many more applications which can be explored and exploited in different area of SET(Science,Engineering and Technology) related domain.In the future Work, it is proposed to perform the IoT based simulation on the real time test bed using tools such as CupCarbon Simulator. The Routing of the messages between the nodes of the IoT Enabled network would be shown using the MQTT(Message Queuing Telemetry Transport) and COAP(Constrained Application Protocol) by writing the suitable Java Code with it's execution in ECLIPSE PAHO IDE Environment.

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