The Thought of Smart villages based on Internet of Things and WSN

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Abstract— the plan of Internet of Things (IoT) and Wireless Sensor Network is the expectations vision of technology. The basis following its working be the merger of network, web server, mobile and data or Information and connections tools. It enables a variety of devices or strategy in a scheme to converse and act together through every new to carry out their job in a pleasant-sounding method [27]. and the Wireless sensor networks (WSNs) are work of fiction major wireless networks with the meaning and consist of distributed, low-power, small-size policy using sensors to helpfully bring together information from beginning to end infrastructure less ad-hoc wireless network[16] The rising population of the world makes it essential to smooth the progress of the cities and villages to role in a smart way. Hence, the thought or design of Smart cities came addicted to organism. These cities utilize the information or data from sensors and using a wireless sensor network technology, other remote devices and evaluate the data to take suitable events. This paper extends the plan of Smart cities to Smart villages and using an IoT and WSN. It focuses resting on the key areas of concern in the village viewpoint and evaluates the applications of IoT and WSN in those areas. It provides a wide-ranging vision in the midst of high opinion to development in the quality or excellence of life in villages or cities.

Keywords— : Smart Villages, Internet of Things, Smart cities, Big data, Cloud computing, Information and Communication Technology, Wireless sensor networks, Email, Threat, Sensor node.

I. INTRODUCTION

According to the definition given by ITU, "The IoT describes a worldwide network of billions or trillions of objects that can be collected from the worldwide physical environment, propagated via the Internet, and transmitted to end-users. Services are available for users to interact with these smart objects over the Internet, query their states, as well as their associated information, and even control their actions" [18]. Its main principle is to create a large network which consists of different smart devices and networks to facilitate the information sharing of global things from any place and at any time [19]. IoT is the future technology in communications. It is the key behind the smart cities and villages concept. It enables all the objects in a system to behave in a smart way i.e. they all interact and coordinate with each other for smooth functioning of the system. The objects are connected via a wireless network. The objects or devices will be embedded with intelligent decision making components. The technologies used in IoT are RFID, 3S, WSN, Cloud computing etc.

Radio Frequency Identification (RFID) is a technology that assigns identifiable tags to various objects and devices. These tags transmit information which is read by a RSID reader and is then used as per the requirements. These tags turn the normal objects into smart objects in IoT [20]. Sensors are also used to collect and interpret the data from various resources. The 3S technology consists of Global Position system (GPS), Geography Information System (GIS) and Remote Sense (RS) which provides the details about the whereabouts of different objects using sensors or satellites etc. and processes that information. Wireless Sensor Network (WSN) is used to transmit the information in IoT. It consists of a network and resources for data storage and computation which are provided by Cloud services (location-independent). These services can be provisioned for the area where they are required very easily. The concept of Smart cities has originated from the Internet of Things technology (Fig 1). It offers a neat and efficient way to implement IoT in day-to-day life by introducing technology in all the jobs of a modern city. Internet was conventionally used to connect computers or mobile phones. Likewise, Internet of Things will connect every possible device which we can tag as a smart device. All such devices can communicate with each other and act accordingly. In countries like Japan, the Internet is being used to connect such devices. For developing countries like India, the rise in population has necessitated the use of available resources in the best possible way. IoT is emerging as the savior for such increasing demands for efficient usage of resources.
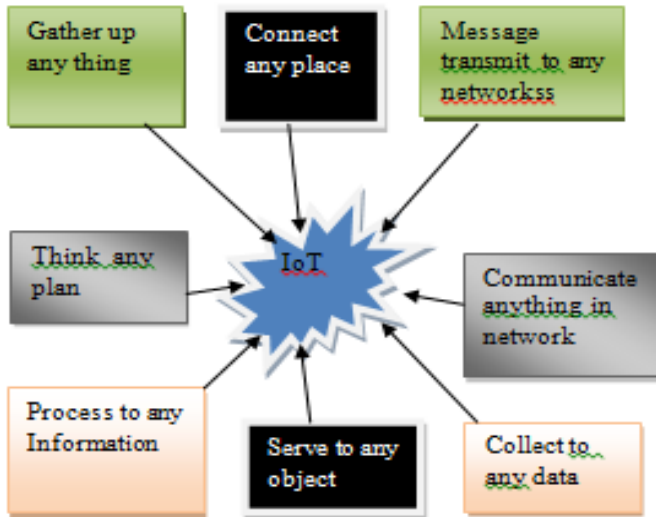
Fig. 1 Internet of Thing

II. DESIGN OF SMART VILLAGES OR CITIES

A big percentage of our population lives in cities. Hence, the researchers as well as the governments concentrate their efforts towards the development of smart cities which are self-sustainable and technologically advanced. These cities can use their resources in a smart and restrained manner.

The same idea can be extended to the villages. Rural population comprises a good portion of the total population of a farming-based economy like India. The life of people in villages is also tougher compared to their city counter-parts. There is a dire need to work towards the progress of the villages along with improving the life in cities. There are certain ideas in smart cities that can be directly implemented in villages. For example, the use of cameras and sensors in streets for surveillance, sensors for healthcare etc. On the other hand, there are certain sectors like agriculture, cattle/livestock rearing etc which need some improvised ideas for smart working. In the following sections, the various aspects of villages have been considered and how the quality of life in villages can be made better using the IoT and Smart village model. The first step in designing a Smart village will be the identification of all the objects which will communicate with each other. Then a large number of sensors, surveillance cameras, buttons and switches for emergency and other fixed devices will be installed. These sensors and devices will be connected to the Internet and produce huge amounts of data which can then be stored and processed on Cloud servers. This data can further be analyzed for finest usage using Big Data analytics tools like Hadoop. The eventual goal is to achieve smart homes, weather systems, education, surveillance systems, and smart agriculture among others. Fig. 3 and Fig. 4 summarize the technologies used and areas of interest in Smart villages.
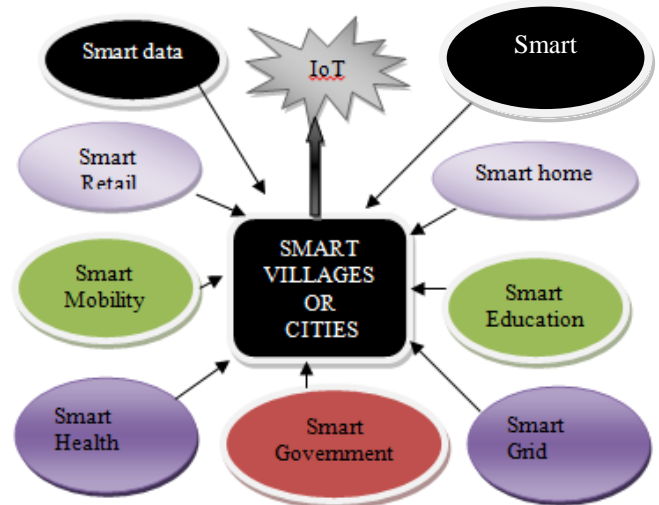

Fig. 2 Smart villages or cities

2.1 Smart Buildings

The homes and buildings can be made smart by the use of sensors and cameras. These will produce real-time data which can be analyzed to take necessary actions. For example, sensors installed in a home can detect smoke and hence start the water sprinklers automatically to combat the fire. Similarly, the sensors can monitor the usage of electricity in the home or building and switch the lights off when not in use. Efficient energy management is the key need in villages where the electricity is not available all of the time. The security of the building can be monitored using cameras and appropriate alerts can be generated in case of any anomalies. The water levels and pressure can be measured in the water tanks and pipes and used to refill the tanks when necessary as well as detect any faults in the pipes.

2.2 Smart climate and Irrigation

Exact climate information can be of large employ to the people of the village. As we know, the majority of population in villages engages in agriculture for their living. The use of environmental sensors to predict weather forecasts can help the farmers to a large extent. Many farming activities like sowing, irrigation and harvesting depend on the weather. Smart irrigation systems can make use of sensors in the fields and remote satellite data to ensure the optimal use of available water resources. If it is going to rain the next day, then watering the fields on that day makes no sense. All this information can be made available to the farmers through message alerts on their mobile phones. The level of water in the dams and canals can also be monitored using sensors and it can be used to predict the future need of water.

2.3 Smart agricultural

As Agriculture is the backbone of all villages, the farmers need to benefit the most from the system of IoT and Smart villages. There needs to be the tracking of the farm produce from the farm to the table. The whole chain of activities can be

monitored and improved using data from sensors and other sources. The people involved in the process are the growers, processors and packers, storage and transport service providers, distributors, wholesalers and retailers [22]. Sensors deployed in the fields can help the farmers with information regarding selecting the crop to sow, yield prediction of crops based on the type of soil or climate, watering requirements using smart drip-based irrigation systems, application of fertilizers according to the nutrient content of the soil etc. The crop diseases and pesticides can also be predicted using data from sensors and crop leaf pictures taken by remote satellites. The farmers can get up-to-date information on their mobile phones. In case of emergencies, alert systems can be activated and provide immediate actions. For example, consider the case of wheat crop which is ready to harvest, a small spark can set the whole field ablaze and cause huge losses to the farmers. Environmental sensors can detect smoke on the onset of fire and start the water sprinklers immediately to control the fire and avoid extreme loss. Likewise, sensors can detect the ripening of the vegetables and fruits and alert the transport service providers to avoid any delays. Thereafter, suitable arrangements can be made in the market to sell the produce.

2.4 Smart Dairy

The secondary occupation of a large number of farmers is rearing cattle for dairy products. The use of sensors and cameras in the barn or shelter can help the farmers in better management of their work. Any changes can be reported instantly through alert messages and required measures can be taken. Favorable temperature for the cattle can be maintained using smart devices. The food, water and health necessities of the cattle can also be monitored in a similar fashion. Grazing the cattle in the open fields is a risky thing if there is no one to supervise it. The use of sensors in the fields can eliminate the job of supervision by a human and it can be done remotely by the farmers.

2.5 Smart Healthcare

Smart health services are needed to improve the quality of life in the villages. The village dispensaries and hospitals need advanced devices which are connected to each other and the doctors. The beds in hospital can be embedded with sensors which can detect various changes in the patient including its movements, heartbeat, blood flow from the wounds and body temperature etc. These reports along with the data generated by various machines like X-rays, CT scans etc. can be sent to the doctor directly. Such services will upgrade the health care sector of the villages.

2.6 Smart observation System

Security is a major concern in villages as there is lesser number of lights, police stations are far off and the villages are located away from the main cities. Due to these factors, the smart surveillance systems are needed in villages. These will

work on the basis of the data generated by sensors and cameras along with emergency buttons located in different parts of the village. In case of a theft or robbery, the nearest emergency button can be pressed and it will send an alert to the nearest police station. The data generated by the cameras can be used to locate the thief thereafter. The data can also be analyzed to avoid such incidents in the future.

2.7 Smart Education

Education is the basic means to implement all the advancements in life. Educating people about the use of new technologies facilitates better implementation. It can be the force behind reducing the digital-divide which is far more prevalent in villages than the cities. The whole idea of Smart villages revolves around its people and how efficiently they make use of the components of a Smart village. They can be educated to participate in each and every activity of the village leading to a better lifestyle for its people. Dealing with children and teenagers becomes easier when we educate them in an interesting way. Video games and lectures fascinate most of the children and can help them learn in an interactive manner rather than reading the text-books in the classrooms. Internet of Things (IoT) brings together different technologies like Internet, Mobile and smart devices and hence assists in the learning process. The use of LCD screens and interactive videos can foster the learning in children and even adults. These can be used to educate them to use the facilities provided in the Smart villages in the best way. The village schools can be equipped with Internet and other devices and learning can be made a fun activity turning the schools into Smart schools [24].
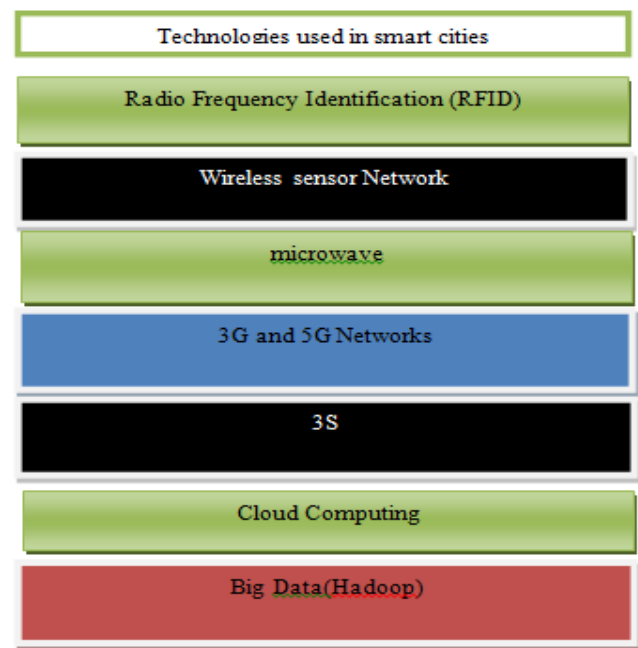

Fig.3 Technologies used in Smart villages

Fig -4: The areas of interest in Smart villages

III. WIRELESS SENSOR NETWORK

WSN, every so often call **wireless sensor as well as actuator networks** are spatially dispersed autonomous sensors node to watch substantial or ecological circumstances, for example temperature also sound, pressure, and so on. along with to helpfully get ahead of their data or information and any records from beginning to end the network to a major site. The supplementary contemporary networks be bi-directional, as well enable manage of sensor node movement. The growth of wireless sensor network be forced by armed applications for instance front line observation; at the moment such networks be worn in a lot of manufacturing as well as customer applications, such at the same time as trade procedure monitoring and organize, appliance physical circumstance monitor, and so forth[17].
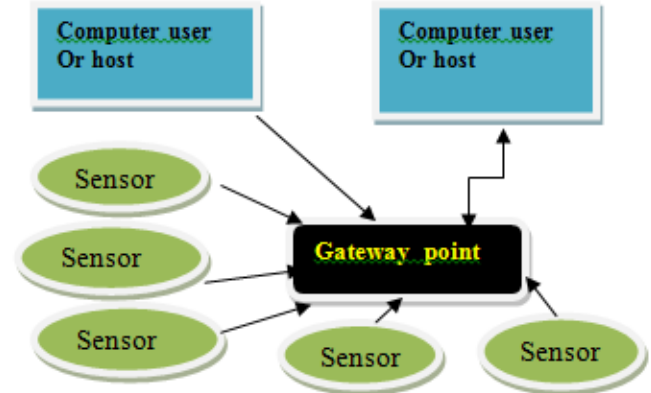

Fig. 5 Wireless sensor network

IV. CHARACTERISTICS

The most important distinctiveness of a WSN include:[17]
- influence utilization constraint intended for nodes by means of string or energy harvesting
- Ability to manage in the midst of nodule failure.
- Some mobility of sensor nodes in wsn.
- Heterogeneity of nodes in wsn
- reabilty to big range of exploitation
- Ability to endure harsh ecological situation
- effortlessness of make use of

V. CHALLENGES IN WSN

here are subsequent challenges happening within the wireless expertise which are specified in the following two categories -Challenges against Internet[16] [17]:

1. Bandwidth length is tremendously restricted in WSNs
2. provide relaxed
3. force
4 .easy to set about and reciprocated utilize

Gather and Destroy investigate challenge:
1. Medium Access Control (MAC)
2. direction-finding
3. Localization
4. in service Systems
5. safety measures
6. encoding concept and doubt indulgence

VI. CONCLUSION

A hardly any being previously, the plan of Internet of Things, wireless sensor network and Smart cities used to be well thought-out as a potential opportunity. But it has grow to be a actuality in the present day, gratitude to the hi-tech advancements. lots of country include deployed the

occupation of rotating their cities or villages into Smart cities or smart villages to a lot of organizations. The most favorable use of accessible possessions is the require of the hour. rising population has restrained the resources and their tradition. Wsn and IoT combine the benefits of numerous technologies to appreciate the idea of intellectual strategy in a city. This idea can be extensive to the villages as well, improving the quality of life of the populace. As the villages comprise somewhat unlike requirements than the cities, this paper focuses lying on those differences and aims to offer solutions for the identical. a variety of areas of concentration have been explored and suggestions be in addition provided.

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