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Improving Sensor Network in Sustainable City

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***Abstract*—** Lately, we've seen a twist of online internet based totally business sites. It indicates an superb threat to share our surveys and evaluations for distinctive gadgets we purchase. Looking to the score cannot the simplest one assist a client to get an define about the object as an alternative the maximum perfect course is to peruse the audits about the item. Be that as it may, at that point a captivating issue comes up. Imagine a scenario in which the quantity of surveys is within the hundreds or hundreds. Which contain of 10 to 15 pages at that factor it is virtually no longer possible to experience each one of these surveys because of wastage of time and exertion. Here comes the importance of audits. To mine profitable information from audits to recognise a patron's tendencies and make a precise cease pivotal. In this work, we recommend a sentiment based rating expectation technique to take care of this difficulty.

***Keywords*—** Energy efficient, Green city, Hybrid optimization, IoT, PSO, Raspberry Pi, WSN.information.

I. INTRODUCTION

Wireless Sustainable towns should have a large name for in future. So it is very essential to expose the city to keep it sustainable. In a sustainable metropolis, a huge variety of sensors and gadgets are interconnected the usage of IoT to help handling issues like air pollutants, waste management, forest hearth and power efficiency[1]. The excessive exploitation of herbal assets and growing pollution are annoying the surroundings in addition to the everyday living situations. Monitoring and maintaining a city are more hard duties than growing or constructing them[3]. So, tracking the use of an strength efficient IoT enabled wi-fi network and statistics analytics will enhance the overall overall performance of the device[5]. The complete town is included with numerous sensors in step with the parameters to be monitored. The sensors can be temperature sensor,humidity sensor, and so on. Digitalization can be considered as a revolution of digital technologies where people and things are interconnected for every possible need. Its aim is to benefit the people with the help of internet services. The evolution of internet can be realized as a sequence of steps as follows: Initially we introduced the concept of network of computers known as Internet of Computers. When people got connected to internet through social media and other networking games, Internet of People emerged. Recently, a rapidly growing network of things has been launched and it is known as Internet of Things (IoT). The basic structure of IoT is shown in Fig. 1.

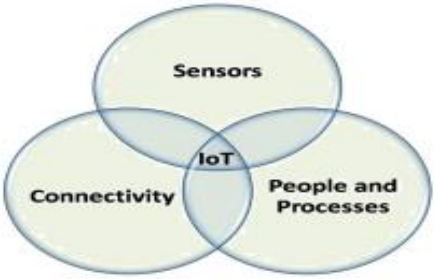

Fig. 1. Basic Structure of IoT

It consists of sensors, connectivity and people and processes. Things connected to internet collects data using embedded sensors. Then, the data is digitized and placed into networks. With networked data, we can create bidirectional systems where people and processes integrate for better decision making. The IoT based technologies minimizes human effort, improves resource utility and creates smart applications like security system, medical and healthcare systems, environmental monitoring, weather control, transportation etc.

As part of the digitization of India, a campaign known as 'Digital India' has been launched by the Prime Minister of India, to transform our country into a digitally empowered society. Its main motive is to connect rural areas with high speed internet networks. The digital space of our country is undergoing various transformations and the most recent entry into the digital space is IoT. As part of the Digital India Program, our government has taken several initiatives for the development of IoT industry in the nation. They have come out with a draft policy on IoT which mainly focuses on smart city developments such as smart parking, intelligent transport system, smart energy, citizen safety etc. The other notable initiatives of IoT are delivering education, health, security and financial services to remote areas. In this manner, IoT provides a bridge between rural and urban areas.

This paper details the design and implementation of an IoT based security system in home/building. In the present scenario, ensuring safety and security has become an inevitable essentiality. Since it is well known that influence of modern technology has reached its peak, demand for security systems are going up progressively. Modern home needs intelligent systems with minimum human effort. With the advent of digital and wireless technologies, automated security systems become more intelligent. Surveillance camera helps the user to get a remote view of his home and the sensor networks add extra security features depending on the type of sensors. Adding WiFi to security systems enables faster data transmission, and it will help the user to monitor and control the systems globally.

II. LITERATURE REVIEW

(i). Weather MonitoringSystem:
Some digital and analog sensors are used on this gadget to measure the environmental parameters. This records from the input sensors will then be examine with the aid of the server, i.E. Raspberry Pi and saved in CSV as well as text documents. The sensors accumulate statistics of diverse environmental parameters and provide it to Raspberry Pi which acts as a base station. The Raspberry Pi then transmits the information the usage of WiFi and it is going to be displayed at the computer[8]. The client-side web interface is implemented with HTML, CSS, JavaScript, Ajax, jQuery, and Flot. HTML and CSS is used in combination to mark up and style the web page.

JavaScript is used for client-side scripting to enable dynamic display and interactive user interface. jQuery is a widely-used JavaScript library that greatly simplifies JavaScript programming. Ajax, an acronym for Asynchronous JavaScript and XML, is a group of interrelated web development techniques used on the client side to create asynchronous web applications 8. With Ajax, client-side web applications can exchange data with a server asynchronously in the background without interfering with the display and behavior of the existing page. Flot is a JavaScript plotting library for jQuery, with a focus on simple usage, attractive looks and interactive features 7. Generally, it supports all browsers that support the HTML5 canvas tag. In our design, Flot is used to visualize sensor data in both static and dynamic real-time graphical displays. In the real-time display mode, instead of refreshing and redrawing entire web page, Flot provides the capability to only update the chart with new data that are fetched periodically from the server. Ajax and jQuery are used in our design to feed the Flot charting functions with continuous flow of data from the MySQL database on the server via the web services written in PHP. The data is serialized into the JSON (JavaScript Object Notation) format to be communicated between server and client. In the current implementation, we have designed three front-end utilities for experimentation and demonstration purposes: real-time display in chart (CHART), data access (DATA), and system configuration (CONFIGURE). With the data access utility, users can download and view sensor data stored in the database conveniently. Users can also monitor the sensor data updates in real-time using the real-time display utility. With the system configuration utility, authorized users can configure the sensor network system with a number of global and node-level settings, including measurement period, which sensor nodes to measure, and which sensor to measure.

The configuration requests generated by users on the web interface are sent asynchronously to web service on the server and the requests are inserted into a command table in the MySQL database. The gateway application monitors the command table periodically for any configuration updates to be sent to sensor nodes. The command table is used to share data between gateway application and web application. Such a design decouples gateway application and web application and greatly simplifies the inter-process data sharing problem. In general, environmental monitoring applications are tolerant to delays in the order of seconds or even minutes, so that the amount of delay introduced by such a method is acceptable in our targeted application scenarios. The sensor nodes and base station can work independent of web application. Authorized users can directly access the data and command tables in the database and remotely configure sensor nodes from Raspberry Pi by logging into its Linux system. On the other hand, the web application can be updated without interfering or interrupting sensor nodes and the gateway application residing inside the Raspberry Pi. Such a design makes it very convenient to perform application-specific customization and revision of the system.

The client-side web interface is implemented with HTML, CSS, JavaScript, Ajax, jQuery, and Flot. HTML and CSS is used in combination to mark up and style the web page. JavaScript is used for client-side scripting to enable dynamic display and interactive user interface. jQuery is a widely-used JavaScript library that greatly simplifies JavaScript programming. Ajax, an acronym for Asynchronous JavaScript and XML, is a group of interrelated web development techniques used on the client side to create asynchronous web applications 8. With Ajax, client-side web applications can exchange data with a server asynchronously in the background without interfering with the display and behavior of the existing page. Flot is a JavaScript plotting library for jQuery, with a focus on simple usage, attractive looks and interactive features 7. Generally, it supports all browsers that support the HTML5 canvas tag. In our design, Flot is used to visualize sensor data in both static and dynamic real-time graphical displays. In the real-time display mode, instead of refreshing and redrawing entire web page, Flot provides the capability to only update the chart with new data that are fetched periodically from the server. Ajax and jQuery are used in our design to feed the Flot charting functions with continuous flow of data from the MySQL database on the server via the web services written in PHP.

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(ii). Building Monitoring System using RaspberryPi:
The principal goal of this paper is to make use of Raspberry Pi as the principle factor of the Building Monitoring System to display the environmental parameters and additionally to screen the energy intake of the building surroundings inorder to increase an powerful environment tracking system which may be used correctly to execute statistics analytics for destiny strength harvesting There are basically four common modules available in this architecture viz., Data acquisition module which includes all of our sensors, Power Supply module, Processing module and Wireless Communication Module. The Power Supply module is connected with all the other three modules in order to power them up and initiate the process.

The Data Acquisition Module includes all the Temperature, Pressure, Humidity and Light Sensors in order to collect the ambience data. The Wireless Communication module involved here is 2.4 GHz ZigBee protocol for data transmission to the Controller/Gateway wirelessly. The Processing Module has got its own Processor, signal processing units and ADC to convert the sensor data to metric unit format for user convenience. This Gateway has its own Ethernet port for router connection which can be a wired or a wireless one according to the user's requirement and convenience. This system is specifically designed for the purpose of collecting the ambience parameters viz., Temperature, Pressure, humidity, light, humidex, Dew Point, Heat index etc. and record them as a new individual file on daily basis and can also record them into a data base for utilizing those data effectively by variety of graphical representation for further future use cases. In our case, this web service can provide totally and separately about the details like current live ambience parameters, location of the sensor and individual graphical representations of the environmental parameters of the deployed sensors. [5].

(iii). Methodology for Monitoring Manufacturing Environment by using WSN andIoT:
This paper has developed for designing a WSN with the intention of tracking manufacturing environments. Also, this technique is a more seamless integration of WSN and the IoT. A case take a look at of temperature monitoring in an office surroundings turned into provided for demonstrating and proving the proposed methodology[6].
through the internet with the help of an ESP8266 WiFi module. The projected system delivers sensor data to an API called ThingSpeak over an HTTP protocol and allows storing of data. The prototype has been used to monitor and analyse real time data using graphical information of the environment[6]. The study focused on identifying the context and classifying the existing studies in IoT in an industrial setting. Although the study highlighted the challenges and opportunities in IoT for novel and veteran researchers in this domain, only related articles published in the web of knowledge database from 2009–2013 were used in the study. Meanwhile, another study reviewed the existing technologies of IoT and sensor networks in which the authors defined a six-layered architecture of IoT and highlighted related issues and challenges. However, the study limited its scope to architecture issues and challenges. In Fortino et al., a comparative study was presented wherein the authors proposed a comparison based on IoT layer's vital characteristics and the kind of architecture being used. Similarly, Ferrag et al. surveyed existing blockchain protocols used in IoT networks and highlighted the existing studies that focused on blockchain and further described the identified blockchain . That study also discussed blockchain application domains in IoT as well as provided a taxonomy and state-of-the-art methods used in the reviewed studies for securing and privacy-preservation of blockchain technologies. Additionally, Luong et al. surveyed data collection and wireless communication in IoT by utilizing pricing models and economic analysis . The authors reviewed the existing literature on pricing models, applications, and economic analysis for data collection and wireless communication in

IoT. Furthermore, the survey highlighted research problems with future research directions for applying pricing and economics to IoT.

The protocols' weaknesses and strengths were also presented to enable researchers to choose an appropriate protocol to suit their needs. However, the paper did not discuss significant performance metrics in WSN, such as reliability, scalability, efficiency, and so on. Oliviera and Rodriques presented a survey on WSN solutions used in monitoring environmental applications. The authors critically analyzed related projects on environmental monitoring with real deployments and highlighted future studies' challenges. Hence, the paper focused on monitoring environmental application use cases. In another study, Yang et al. conducted a survey describing the IoT security and privacy issues. The study started by presenting the solutions to the IoT device limitations and then highlighting the current IoT attacks' taxonomy. The authors further reviewed the IoT access control schemes, authentication, and architectures of the existing studies. However, only limited solutions were reviewed to address the study's challenges. Hodge et al. surveyed WSN technology in the railway industry, focusing on practical engineering solutions where sensor devices were used. However, the paper only examined the railway industry use case. Similarly, Das et al. presented a survey study on WSN virtualization, which provided a forum where multiple applications can exist in a single framework of sensor infrastructure, thus minimizing the deployment cost, the number of sensors, and so on, of the sensor infrastructure. Another study surveyed data collection in WSNs, provided a standard classification of WSN architectures, and discussed the process of data collection and the current problems. The study also described other important data collection processes, such as performance measures and evaluation mechanisms not discussed in other studies. In a survey by, the authors discussed the existing works on WSNs and WSN packages, such as design features, applications, and lifetime prediction models. Another study presented a comprehensive survey of existing studies concentrating on using WSNs for structural health monitoring. The authors focused on WSN telecommunication in the existing structural health monitoring (SHM) studies and highlighted the challenges and future trends in the application of SHM to WSNs. Figure 3 shows the general architecture of WSN.

(iv). WSN Using Raspberry Pi and Arduino for Environment MonitoringApplications:
This paper describes a wireless sensor network system with Arduino, Raspberry Pi and a number of open-source software packages. The system has a number of features including low cost, easy to deploy and easy to maintain. The raspberry pi is a low cost, low power credit size single board computer which has recently become very popular.
The raspberry pi is the cheapest ARM11 powered Linux operating system capable single board computer board. This board runs an ARM11 microcontroller @700MHz and comes with a 512 Mega Bytes of RAM memory. In this paper, raspberry pi B+ model is used, as this model has better specifications as compared to other raspberry pi models. It supports a number of operating systems including a Debian-based Linux distro, Raspbian which is recommended by raspberry pi foundation, which is used in our design. Raspberry Pi can be connected to a local area network through Ethernet cable or USB Wi-Fi adapter, and then it can be accessed by more than one client from anywhere in the world through SSH remote login or by putty software by just putting raspberry pi ip address in it. The raspberry pi is booted by external SD or micro SD card.
Some sample deployment and measurement results are presented to demonstrate the usefulness of the system[7].

III. SYSTEM ARCHITECTURE

In Fig 1,The goal of the venture is to create an green tracking device that video display units a sustainable city. The efficient monitoring can make certain earlier prediction of environmental dangers[4]. The metropolis is blanketed with a whole lot of sensors primarily based on the parameters to be monitored. These sensors gather records in a everyday interval of time. The metropolis consists of a whole lot of places, those places are classified based on its sensitivity towards environmental pollutants, sound pollutants, air pollutants, water pollution, temperature, humidity, and so on[5,6,7]. The sensors collect information and keep it in a database. The collected records is of big size and we will classify facts to separate the useful data from the massive accrued information. The output may be displayed on a pc/computer. This extracted information is analyzed and reached in a final end. The accrued information may be taken into consideration for detailed statistics analytics so as to discover the general situation in the environment, assist us to are expecting the destiny performance, which allows the authority to plot the vital precautions and thereby make certain the pleasant overall performance of the sustainable metropolis[7].

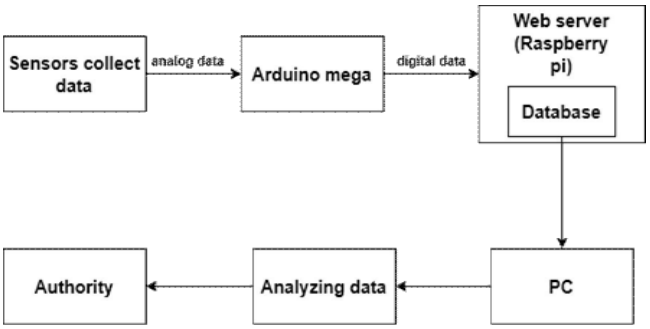

Figure 1: System architecture

MODULES
There are 5 modules:

- Sensors
- Arduinomega
- Web Server(Raspberrypi)
- PC
- Dataanalysis

IV. EXPERIMENTAL ANALYSIS

The sensor nodes acquire environmental statistics at preset time and upload it to the Pi cloud. The information inside the cloud can be displayed on the internet interface. With the goal to test the reliability of the design, sure experiments are executed and effects derived. The fig 2, graph shows the information accumulated by way of smoke and sound sensors. The statistics inside the graphs are acquired through extracting the most concentration values from all the values collected from extraordinary sensors. The x axis represents the time and y axis represents attention.

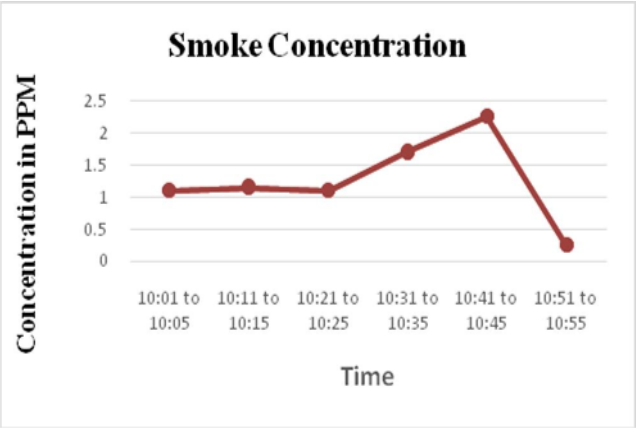

Figure 2: A sample data of smoke concentration

V. CONCLUSION

This project, we introduce an efficient IoT enabled wireless sensor network to monitor sustainable cities. A city is a place where people with different interests, requirements and expectations live. Monitoring a city is an important and challenging task which keeps the city sustainable. Our system monitors the city using variousIoT enabled sensors and stores it in a database. The collected data can be used for predicting the future performance of the city. It also helps us to predict the disasters and help us to take necessary actions and they ensure the best performance of the city. The temperature, pressure levels can be clearly identified based on this system at the device location. The internet enabled device is capable of monitoring the quality of air, rain, temperature, pressure, etc. Further modifications can be done to this by using some scheduling algorithms to schedule the monitoring. Continuous monitoring may decrease the battery life of the system.

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