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IOT BASED INFORMATION SYSTEM FOR ENVIRONMENT MONITORING AND MANAGEMENT USING K MEDOID ALGORITHM

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ABSTRACT
Environmental problems such as climate change and natural disasters have received much interest in recent years. Environmental monitoring and management provides us different methods to gain deeper knowledge about climate changes, natural disasters and the spread of infectious diseases. The study on environmental changes and conditions helps to improve the habitat and economic conditions. Research in climate changes helps to derive different solutions for better agriculture, habitat and efficient lifestyle. The Internet of Things (IoT) is a notion in which Internet will be integrated into everyday objects that we use in our house, by tagging chips or sensors thus creating an intelligent network of the physical objects. IoT based information system for environmental monitoring and management provides an efficient mechanism for monitoring the temperature and humidity changes and management of the same. This new concept is the combination of IoT and data mining. Internet of things offers large amount of data and data mining activities offers information extraction from the unstructured big data. The proposed system uses K medoid for clustering the weather based data. The application of IoT based information system for environmental monitoring and management includes fire detection, in the field of agriculture etc.

INTRODUCTION
Weather plays a significant role in the operation of various services and industries in the day today life. Nowadays, there are many databases for weather data. Naturally, there are many information systems established to manage and to operate weather data. The information system that uses these weather data helps us to improve one's ability to take decisions. An information system consists of a chain of operations. The operations include planning the observation process, accumulation of data, storage and analysis of data, and deriving information from the data for decision-making processes.

The Internet of Things (IoT) is altering the way businesses exploit technology. The Internet has evolved as a mode to link people, share the information uploaded by different people, find solutions to problems and reporting the same. With the advent of smart devices and sensors, the Internet will progress to the Internet of Things with billions of connected devices, machines and sensors for capturing, gathering, evaluating, observing, and sharing valuable information.

With more and more objects and smart devices connected through wireless or wired network, the influence and value that IoT gives to our everyday lives become more predominant. It helps people to make better and efficient decisions such as taking the best and small routes to work or places. New services such as remote health monitoring, environment monitoring, and nationwide planning for faster and quicker disaster recovery can be established using IoT. IoT helps government in integrating different agencies for collecting, processing and managing the data. For enterprises, IoT gives about substantial business advantages from improved management to tracking different assets and products with efficient cost savings.

How can we incorporate IoT to environmental monitoring? It's a question that needs answer. Deploying different sensors to locations for collecting data and then store it in a database for further processing. Then extract relevant information from the collected raw data. The problem arises in the case of types of data, because information from different objects are encapsulated and processed. The proposed system for environmental monitoring and management using IoT, focuses on the IoT application in the new era of environmental informatics, and inculcates a new concept for environmental monitoring and management in the future.

The application of data mining to environmental monitoring has become crucial for a number of tasks related to emergency management. Over recent years, many tools and techniques have been developed for decision support system (DSS) for emergency management. Here a graphical user interface (GUI) for environmental monitoring

and management system is presented. This interface allows accomplishing (i) data collection and observation and (ii) extraction of the data for data mining. Sensors are used for collecting data from the environment. These collected measures are stored in a platform for processing and management. K Medoid algorithm is used for clustering the environment data. Section II gives an overview about the related work, section III defines the proposed system and section IV gives the implementation details.

RELATED WORK

Internet of Things

The creation of the Internet was a significant transition in the way people attain information, communicate with each other, and make conclusions. Now, the Internet is expanding its reach to a range of devices that can gather and analyse physical data and react to that data in a variety of applications that we've never seen before. This "Internet of Things" marks another dynamic shift in the history of technology. How to describe Internet of Things? According to Cisco it is Internet of Everything. A system falls under the Internet of Things definition if it meets the following norms, known as the 3 Cs:

1. It must connect – to the physical world around itself collecting information, to other things in order to interact with them effectively, to the internet or a network, etc.
2. It must compute – by processing the inputs it receives in some way and making them meaningful to other systems.
3. It must communicate – with the network, with other things, and with the user if necessary.

Sensors

For capturing the real world data sensors play an important part in Internet of things. Sensors can be defined as smart devices change a physical parameter such as room temperature, humidity, blood pressure, precipitation or wind speed into electrical signals. E.g. Output obtained from a glass thermometer. Smart devices are a conduit between the real world and the internet.

We need sensors to get physical parameter data which are used to make decisions, control systems etc. Once the physical parameter (temperature, displacement, acceleration, flow, chemical and biochemical parameters, such as concentrations of gases, ions or molecules, and molecular interactions) has been converted to an electrical equivalent it is easily input into a computer or microprocessor for manipulating, analyzing and displaying. Information from the data can then be used to make better decisions and smarter solutions leading to for example a smarter city which in turn results in better quality of life for the people. To get information from these large volumes of data we need data storage, computational analysis and visualization infrastructure. To achieve this we have decided to develop a web application.

PROPOSED SYSTEM

Environment monitoring and management is very big crisis for the entire world. Taking decision and finding solutions to the problems in the environment is becoming more challenging. The aim of this thesis is to present the disputes related to environmental data sets and to address these in order to find resolution. Environmental data sets impart a number of data management issues including the collection of data, its data integration, and extracting information from the big data obtained from the sensors. Environment data that acquired from the real world are very vigorous and this introduce additional confronts ranging from data collection to integrating the different types of data from different scenarios, meticulously as these data sets are unstructured data. Statistical procedures are very effectual and economical way to analyze small and static data sets but they are not pertinent for dynamic, real-time and large data sets. The usage of data mining algorithms for extracting information from environment data aids to procure right decisions at right time.

IoT based integrated information system for environmental monitoring and management introduces an efficient mechanism for collecting environmental changes, processing the collected data, and displays the analyzed data. Here it collects the physical data related to temperature and humidity. Environmental changes play an important role in our everyday life. Our agriculture field depends upon the climatic changes. So environmental monitoring and management becomes essential for acquiring physical data, analyzing the environmental changes, visualize the analyzed the data and provide solutions to the problems arises due to environmental changes.

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IoT based environmental monitoring and management system uses sensor technology for collecting the data. Temperature and humidity sensors are used for sensing temperature and humidity measures from the real world. As per the application requirement different sensors can be incorporated. Combined temperature and humidity sensors are available in the market nowadays. For remote environmental monitoring sensors are deployed at different places. These sensors are connected together by means of ZigBee protocol. ZigBee uses Xbee module for interconnecting the sensors. It can act as a router as well as data collector at the destination side. While sensors are connected together mesh topology is better for better power utilization of the sensors.

After collecting the data, it is transmitted to the application gateway. Sensors contain electrical signals. These signals are transmitted to the application gateway, where signals converted to readable format. The gateways are responsible for collecting, processing and transmitting the data to the internet server. The gateways collects data from sensors, process the data, store it, and periodically transmit the field data to the application server using long-range communication medium if the sensors are placed at different places. The application server enables permanent data storage of the collected data, and provides interfaces for data access.

IMPLEMENTATION AND RESULT

DHT11 sensor is used for capturing data from the environment. Every DHT11 give us temperature and humidity data. DHT11 sensors are really low cost and more or less accurate. Display temperature in Celsius degree and 5% of accuracy for humidity. This DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a standardized digital signal output. By using the elite digital-signal-acquisition method and temperature & humidity sensing technology, it guarantees high consistency and tremendous long-term stability. This sensor complex includes a resistive-type humidity measurement component and an NTC temperature measurement component, which measure both temperature and humidity and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast and quick response, anti-interference ability and cost-effectiveness. It is small size in size, low power consumption characteristic and up-to-20 meter signal transmission making it the best choice for enormous applications, including those most demanding ones. Power supply needed for DHT11 is 5V, temperature range in between 0-50C and humidity range in between 20-90%RH.
DHT11 temperature and humidity sensor, LM35 sensor connected to the Arduino using a bread board. Based on the application for remote environment monitoring sensors can be connected using ZigBee, Wifi etc. ZigBee uses Xbee module which acts as a router as well as data collector. After that Arduino is connected to the computer using a USB cable which enables serial transfer of captured data to the computer. Transmission rate is set as 9600 bits per second.

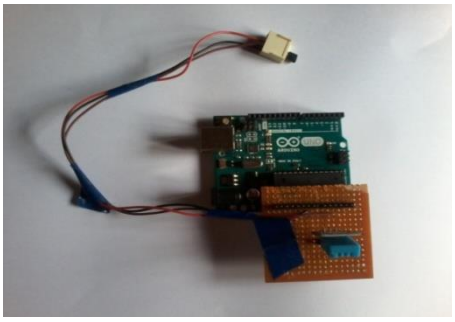

Fig 4.1 Sensors connected to Arduino

Arduino consists of DHT11 library. Sensor transfer the analog data and it its converted to digital by plotting the voltage between 0-5V to 0-1023 and then multiplying with 0.5. A delay of 700ms is set for the system to settle. This is done to tackle the unstable situation. DHT.read11 reads the data from the pin. Then the analog data is converted to digital. It displays the humidity data first and then the temperature data from the DHT11 sensor and LM35 temperature sensor.

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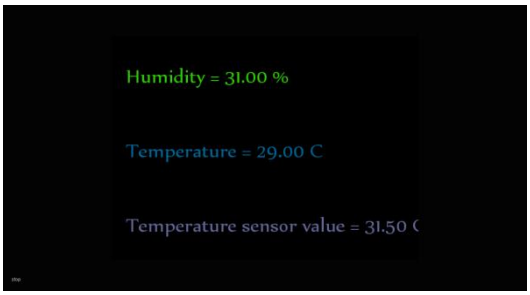

Fig 4.2 Display

Figure 4.2 represents captured temperature and humidity values using the DHT11 temperature and humidity sensor and LM35 temperature sensor. Temperature sensor value represents the temperature value captured by LM35 temperature sensor.

A web interface is designed for the entering the data collected by using the sensors and from other mediums. Here temperature and humidity is uploaded using the data sets obtained from the DHT11 sensor. Rainfall, precipitation and wind speed data is obtained from different databases. Then broadcast the data to the database. MySQL database is used for storing the data. Only authenticated user can upload the data to the server.

K Medoid algorithm is used for clustering the real data sets. Authorized users can view the clustered output. Clusters are formed for five values like humidity, temperature, rainfall, precipitation and wind data sets.

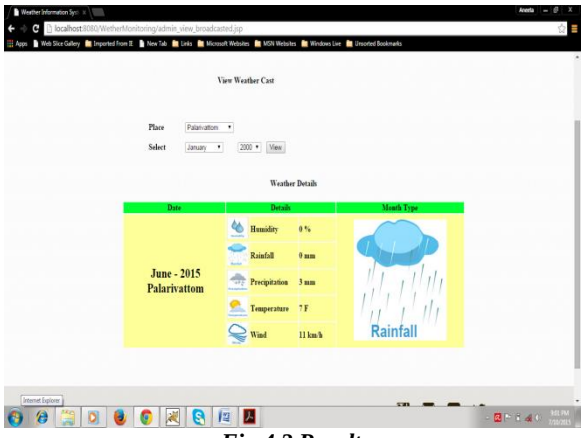

Fig 4.3 Result

K Medoid algorithm is well suitable for data sets that consist of noise and outliers.

CONCLUSION

With the enhancements in technology, it is accepted that the availability and accessibility of internet is everywhere and online every time. Because of the advancement in nanotechnology and microelectronics, the price of electronics devices declined. This lead to the wide spread usage of sensor networks for monitoring and collecting the data. Low cost smart sensor node development enables easier interconnection of devices and corresponding information can be available globally. With the characteristics such as scalability, reliability, fault tolerance and effective power consumption of nodes and transceiver, IoT have facilitated complex computational ability to internetwork and heterogeneous smart objects easily and facilitate availability of data anywhere at any time at any place.

The IoT based environmental monitoring and management system establishes a novel IIS for regional environmental monitoring and management using the new paradigm Internet of Things, for improving the efficacy of complex tasks, the proposed IIS combines IoT, data mining algorithms for knowledge discovery and decision making and environmental monitoring and management. The integrative system established is precious for the perception, transformation, processing, management, and sharing of information from multiple sources in

environmental monitoring and management, and it also imparts a new idea for the future work, especially in the era of ever increasing data i.e. big data and IoT. It is an innovative endeavor on the development and application of IIS based on IoT for environmental monitoring and management, along with the advantages there are also several problems needed to be resolved in the near future.

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