Applications in Smart Cities Using IoT: A Review Paper

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Abstract
In last two decades evolution of Internet of Things has brought revolution in field of information and technology. In urban areas due to over population, there are lot of issues regarding resource allocation and resource management. Use of IOT can be helpful for managing the utilization of resources. Internet of Things technology helps to deal with real life challenges by providing quality services to perform daily life tasks. Adoption of this technology has led towards formation of smart cities. As devices in IoT network generate, consume and share large amount of data so we need a cloud where we can store, consume and share the meaningful data which leads towards emergences of lots of applications which has changed our social and economic life. This paper we are going to discuss traffic management system and environment monitoring applications which are evolved due to emergence of Internet of Things. We will also dicuss some advantage and disadvantages of these applications and made a comparative table of these applications.

Keywords:
Internet of Things, Cloud Computing, Traffic Management System(TMS), Data acquisition, Data Parser, Microcontrollers, Environment Monitoring System.

1. Introduction

Internet of Things (IoT) time period shows a widespread idea for the capacity of network policy to enjoy and gather facts as of round the humanity, after which proportion that facts diagonally the Internet in which it could be process and implemented for diverse exciting functions. The IoT is constructed from elegant equipment interacting and speaking by one-of-a-kind machines, items, environments and infrastructures. Now a days each folk are related with every other using masses of communiqué manner. Where maximum famous verbal exchange system is internet so in any other word, we preserve state net which join peoples.

The important design of IoT has been spherical for almost many years, and has involved many researchers and industry due to its notable anticipated effect in civilizing each day life and civilization. When topics like circle of relative's appliances are related to a network, they are able to art work collectively in collaboration to give the quality provider as an entire, not as a fixed of separately strolling strategy. This is beneficial for maximum of the actual-international packages and services, and one might as an instance relate it to construct a clever dwelling; home windows can be stopped up mechanically while the ac is grew to become on, or can be open for oxygen when the fuel oven is becoming on. The concept of IoT is particularly treasured or people with disabilities, as internet technology can assist person sports at better level similar to building or society, due to the fact the gadgets can collectively cooperate to act as a trendy device. Message functionality and faraway guide manipulate bring about the following step how do I mechanize matters and based on top of my settings and with modern day cloud-primarily based definitely processing, make topics appear without my intervention?

That's the last aim of some IoT applications. And, for the ones packages to bond with and organize the Internet to benefit this object, they should first end up "clever" (encompass an MCU/embedded processor with a connected precise ID) then related and, eventually, controlled. individual's capability can then authorize a new beauty of offerings that makes life less difficult for his or her customers. The time period Internet of Things become first coined by means of way of Kevin Ashton in 1999 inside the framework of deliver sequence control. Though, within the history decade, the definition has been extra inclusive covering sizable variety of applications like healthcare, utilities, transport, and so forth. Even although the definition of „outcomes has distorted as technology evolved, the number one purpose of creating a computer feel data without the useful resource of human interference ruins the identical. However also uses contemporary Internet necessities to provide offerings for information switch, analytics, programs, and transportation. Fueled by means of the prevalence of devices enabled with the resource of open wireless technology which embody Bluetooth, radio frequency identification Wi-Fi, and telephonic facts services further to embedded sensor and actuator nodes, IoT has stepped out of its infancy and is on the verge of reworking the current static Internet into a totally integrated Future Internet. The Internet mutiny introduced about the interconnection amongst human beings at an notable scale and pace. The subsequent revolution can be the interconnection among gadgets to create smart surroundings. Only in 2011 did the type of consistent gadgets in the world overtake the real extensive style of humans. Now there are 9 billion planned devices and it's far predictable to attain 24 billion devices thru 2020. Now a days all over the place like at railway location, buying malls,

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in colleges an information table is obligatory that provides information about the educate agenda, promotional gives and crucial observe proper now. From instructional organization angle, the trouble is that it calls for some groups of people this is committed to that purpose and that must have as a lot as date data regarding the institute and the recent actions within the institute. The 2d hassle is that a person needs to move in the foundation at the data table a good way to get records from them. The solution of this is to apply a technology and make technology accountable to reply all of the queries requested by way of manner of people. The wonderful tool is Cell phones, which probably exist to nearly every person and that is connectable to web to download ultra-contemporary records. If the records aren't always updated over the net, in those instances in which within the information isn't always being efficient over net, we need to call client service middle for assist. The surprising rise in the populace has delivered many demanding situations in fitness services and in the end, it has led to the scarcity of medical sources. It is in dire need to deal with those challenges and offer a spark off solution primarily based at the restricted assets.

The IoT, cellular, and network connectivity provide the excellent solution due to their less value and smooth-to-use features. The essential awareness of Internet of Things-(IoT-) based healthcare offerings are to provide a rich person enjoys at low cost and improves the quality of existence. The principal characteristic of IoT is to provide connectivity to the available scientific assets and reliable, efficient, and elegant healthcare services to the elderly patients who be afflicted by persistent diseases. The IoT brings clever healthcare device inside the medical area that is generally composed of sensors with clever functionality, a faraway server, and the network. This gadget is centered to offer monitoring with multi-dimensional functions and fundamental treatment inspiration. In Educational establishments have a scenario where in university students can be discovered in any a part of the campus and can miss vital updates collectively with rescheduling of instructions and so forth. Furthermore, students or clients may not be able to understand important information in-time for it to be beneficial to them as they might not be able to bypass thru the ones observe forums frequently. Enabling technologies for the IOT:

2. Related Work

[5] Performed a survey on smart mobility and traffic management using IoT. [nell] discuss different schemes to manage traffic in urban areas and avoid traffic congestion for emergency traffic vehicles. [6] discusses use of different technologies like cameras, GPS and sensors to manage traffic flow. [7] discusses different technical and applications related challenges and deployment of IOT in China, and purposed a generic architecture to overcome IOT related issues. [8] discusses the need of IoT in transport and importance of IoT devices to control the traffic flow automatically. [9] performed a survey by following systematic literature review of different domain applications and present case studies and also discusses the challenges, features and disadvantages of IOT applications. [10] discusses transport applications and also discusses sensors and processing system to manage traffic. [15] purposed a system to monitor environment at far distance. [16] performed a systematic literature review on environment and agricultural applications to understand different challenges, solutions and technologies are developed by using IoT .

3. IOT applications

3.1 Transportation

TMS is one of the major extents of Internet of things. Increase in population is leading towards problems such as fuel and time wastage, causes pollution (e.g. air and sound pollution), traffic load on roads this makes difficult for authorities to control traffic congestion. Due to limitation of resources it is become necessary to adopt IoT to solve these problems. In this paper we are going to discuss different traffic management systems which are provided to control the flow of traffic. At the end of paper, we have presented a table 1 to make a comparative analysis of different traffic management systems.

3.1.1 Smart Traffic Management System using IoT

This system [1] analyzes the details of data by checking the traffic stuffing and also creates the path for the emergency automobiles. System consists of 3 parts. Data is gathered by using different cameras and sensors (smoke sensors, ultrasonic sensors, flame sensors and RIFD). Due to its efficiency and ease of use a monitoring camera is used for detecting traffic congestion. Ultrasonic sensors are used to accelerate the precision to detect the traffic crowed. There are 3 pairs of sensors which are deployed at certain distance from each other to measure the traffic density. Microcontrollers are also used to receive the results from videos and sensors to measure traffic density. 2nd Part is data processing and decision making. In this phase system checks the traffic flow intensity and update time duration of traffic signal accordingly and if there is any emergency situation then system immediately stops routine work and inform the respective department. 3rd part is application and actuation layer which shows traffic congestion flow report to admin on a web page. Purposed model is shown in fig 1.

Purposed System

System shown in fig.1 consist of 3 layers

1. Data acquiring and collecting
2. Processing of data and decision making
3. Application and Actuation layer

1) Data acquiring and collecting

A monitoring camera is the used to detect the traffic on road in the field due to competence and easy to maintain. Due to its high performance and capacity to handle noise Blob detection is the algorithm which is applied to the video at a local server. After traffic detection, a server is used to send the density measured via using image processing technique to the respective microcontroller. Sensors are used to calculate distance via sending sound wave of particular frequency and observe that sound in back direction. Data gathered through sensors and server are send to microcontrollers. To measure cumulative density.

2) Processing of Data and Decision Making

A default time is set for each traffic signal to manage normal traffic flow. When there is increase in traffic flow the system checks traffic intensity and update the traffic signal time by using algorithm. When the system detects any emergency vehicle then system immediately stops the routine work and allow that vehicle to pass by blocking all other traffic signals.

3) Application and Actuation layer

There are 2 types of systems

- delivered duration of a green signal from node to traffic signal
- Showing reports to admin of the system through the web-based portal from a server.

Reports are shown on web pages which are directly linked with that server. System calculate the rush intervals on data saved on local server via use of regression tree to modify report on centralized server on every day.

3.1.2 IoT based smart traffic management system [2]

Traffic Management system shown in fig.2 proposes a traffic management system (TMS) which work on IoT and data analysis. Powerful sensors are used to measure the traffic noise. After analyzing the data obtain from sensors, timer of traffic signal is set by system controller by using traffic management algorithm and data is send to a cloud server by using a Wi-Fi module.

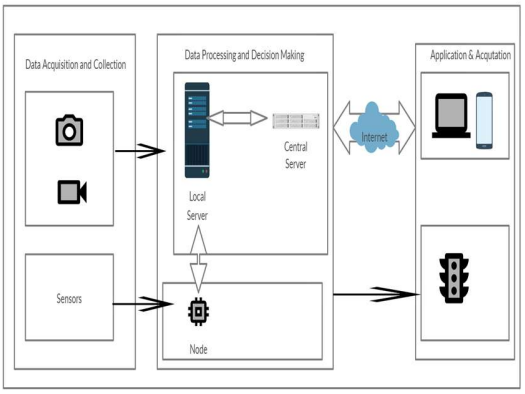

Figure 1 Smart Traffic Management System

The proposed system can predict traffic noise in the intersection point. In case if the system detects an emergency vehicle, it gives preference to pass through by increasing the time duration of particular traffic signal. If there is any violation of traffic signal then, the system can detect the vehicle and charge a heavy fine that is paid through mobile app. This proposed system is user friendly and is very low cost.

Proposed system

Purposed system consists of 2 parts.

- Hardware System
- Software System

Hardware System

RFID module was used to track and identify the tags which are attached to vehicles. A WIFI module was integrated with integrate with sensors to reduce the loading in runtime and real time data is transfer using this module. Ultrasonic sensor releases an ultrasonic wave and collects a reflected wave from the target. After analyzing the time taken between the emission and reception of wave it measures the distance to the target. The detection of vehicles ranges from 2cm to 400 cm at frequency of 40 KHz.

Software System

Arduino language was used to develop the system. Real time graph plots were created by using IoT analytics. A powerful Wi-Fi module send sensors' data to the database through microcontroller. Analysis of data is enhanced by using sensors stored in server database. Code is runs on Arduino IDE that is easy to understandable and also is very reliable. Traffic Wallet mobile application was developed by using android studio.

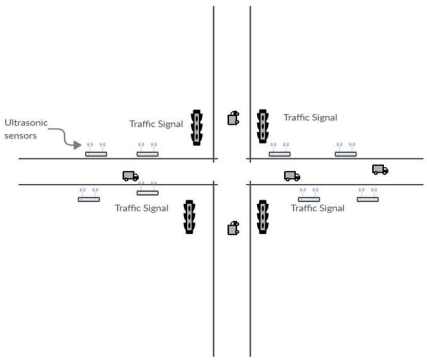

Fig 2: IoT based Smart Traffic Management System

3.1.3 Real Time Traffic Management System [3]

Traffic light duration is determined by traffic congestion on different junctions of traffic signals. Recent studies show the fuzzy logic controller allows the traffic to flow smoother, and reduces the waiting time. The traffic flow on road can be limited by giving extra time on road with more traffic and decrease the red-light time on road traffic signal. In emergency vehicle passes through particular path, the signals on other paths will be red to stoppage other vehicles. This is a very useful feature in case of emergency. The purposed model is shown in fig 3.

Purposed System

Purposed system consists of 2 parts.

- Hardware System
- Software System
-

Hardware System

Security encryption instrument TM4C129E was used to meet the security requirements of the system. TI-RTOS instrument was used for users to do multitasking and facilitate developers to develop the system to make good connection with cloud.

Software System

As this is an embedded system so CCS IDE is used to develop the system which does not only provides better facilities to develop but also for debugging.

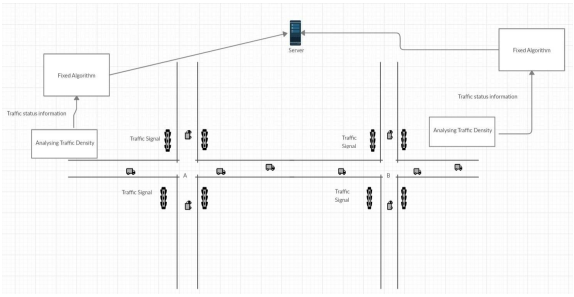

Fig 3: Real Time Traffic Management System

3.1.4 Dynamic IoT based TMS

Investigated solutions for Traffic management in the smart cities. There may be more traffic congestion at particular route and traffic management has to work according to situation. On duty traffic warden may need to control the traffic according to need of traffic flow. [4] developed that system for the 'Makkah' where traffic may need to be control the Kaaba specially at the time of prayer. Purposed system in shown in fig 4.

Purposed system

Purposed system consists of 2 parts

- Hardware
- Software

Hardware

Raspberry pi and Arduino along with a computer are used as intelligent hardware system to be used for traffic management. Raspberry pi has 512 MB of ram and 2 USB ports as input-output to integrate it to external system. Python is used as development language of the system. API called REST is used to connect system with internet which permits HTTP to access the resources by users easily.

Software

Recently an android application developed for smart phone users and is free of cost to download and install form google play store. Application has GPIO interface on the smart phone and permits transferring high level or low levels of logic to remote RPi within the same network zone by using the functionality on the smart phone. There is a limitation of the app that there should be a router to make connection with particular IP of specific range in particular area.

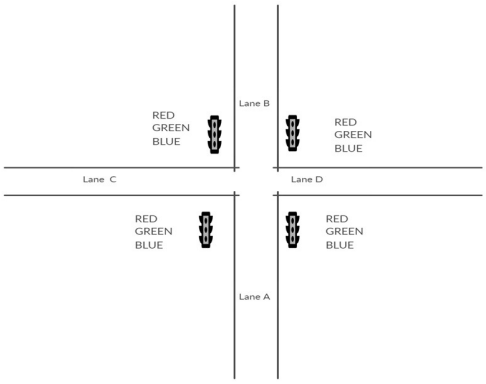

Fig 4: IoT Based Dynamic Road Traffic Management

3.2Environment monitoring system using IoT

In this part we discussed the environment tracking system the usage of IoT. In this part we will support the answer for monitoring the weather circumstances at a chosen vicinity and ship the records to the anyplace of the sector.

3.2.1 IoT Based Weather Monitoring System

The future device [11] is used for monitoring humidity, CO degree, temperature, strain, mild and sound intensity in ecosystem to make the surroundings interactive. All the method will make through wireless communication. The model is shown in figure 5. The proposed architecture is mentioned in a four- tier version with the functions of each character modules advanced for noise and air pollutants tracking. The proposed model includes four-tiers. The tier 1 is the environment, sensor gadgets in tier 2, sensor statistics acquisition and decision making in tier three and sensible environment in tier 4. Here, the tier 1 provides statistics about the parameters under the vicinity that's to be monitored for noise and air pollutants manage.

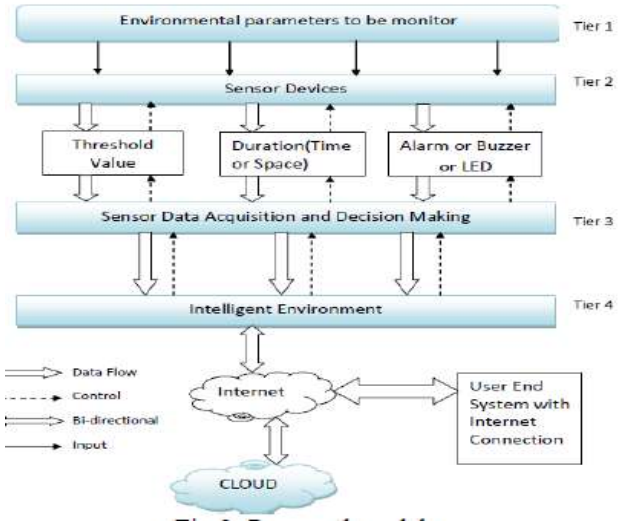

Fig 5: Proposed model

Tier 2 deals with the sensor gadgets with suitable characteristics, capabilities and each of those sensor gadgets are operated and controlled based totally on their sensitivity as well as the variety of sensing. In among tier 2 and tier 3 necessary sensing and controlling actions could be taken depending upon the situations, like fixing the edge cost, periodicity of sensing, messages (alarm or buzzer or LED) and so on. Based on the facts evaluation finished in among tier 2 and tier 3 and additionally from preceding studies the parameter threshold values all through important conditions or ordinary running situations are decided. Tier 3 describes approximately the information acquisition from sensor devices and additionally consists of the choice making. Which specify the situation the records is representing which parameter. In the proposed version tier 4 offers with the sensible environment. Which method it'll pick out the versions inside the sensor data and fasten the edge price relying on the recognized stage of CO or noise ranges. In this tier sensed records could be processed, stored inside the cloud i.e. In to the Google spread sheets and additionally it will display a fashion of the sensed parameters with admire to the specified values. The end customers can browse the information using cellular phones, PCs and many others.

3.2.2 Smart weather monitoring and actual time alert system using IoT

The machine [13] planned is a complicated result for weather tracking that uses IoT to make its actual time statistics effortlessly handy over a totally huge range. The device connecting with tracking climate and weather adjustments like

- Humidity and temp. using DHT11 sensor.
- Measure wing speed with Anemometer.
- To control light using LDR.
- Measure waves using solar sensors.
- Measure CO level in the air using MQ7.
- Measure rainy water level using Ultrasonic sensor.
- Using hygrometer for soil moisture

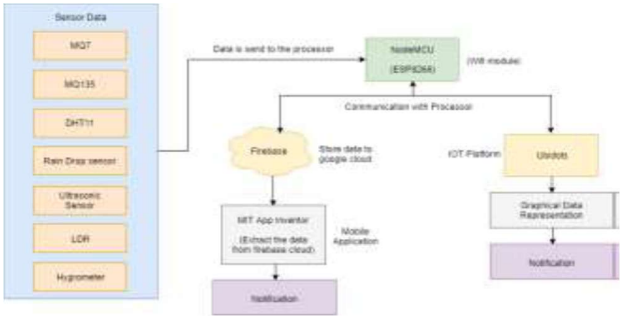

Fig 5: System Architecture

3.2.3 IoT Based Weather Monitoring System

The system [12] which is shown in below fig. used for implementation consists of block NODEMCU and all the sensors are connected with this block. The blocks NODEMCU collect all the information from all the sensors and send all information to thing speak. Behind sensing the records as of distinctive sensor procedure, which are located mainly area of hobby. The sensed statistics could be mechanically dispatched to the internet attendant, whilst a right relation is hooked up with disunite device.

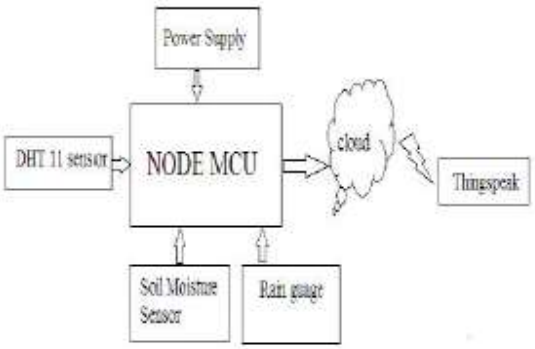

Fig 6 IoT Based Weather Monitoring System

1. Required hardware:

- NODEMCU
- DHT11 sensors
- Soil moisture
- Rain gauge.
-

2. Required software:
ARDUINO IDE

NODE MCU:

This is coronary mind of the device. It offers the platform for IOT. It's a wi fi unit have esp8266 firmware inside. All the opposite sensors are related to this microcontroller. They drive the measured ethics to it and it uploads all the standards to the cloud where the standards are analyze. The makers of this board are ESP8266 Open source Community. It has an

Operating system known as XTOS. The central processing unit is ESP8266 (LX106). It has an in-constructed capacity of 128 K Bytes and a storeroom ability of 4MBytes.

DHT11 Sensors:
It is a 4 pin device and senses the temperature of atmosphere. Linking pin 1 and 2 connected 10k resister. Pin 4 is linked with GND. Pin 2 gives the input to NODEMCU and also it is output pin. Pin 3 will be empty. Pin 3 consists of humidity sensor.

Soil Moisture:
It has two probes and it allow cutting-edge to bypass through soil when it receives the resistance fee to quantify the wetness content material inside the mud. When water is extra it conducts higher power and lesser resistance. The moisture level will be higher.

Rain gauge:
This sensor is used to detect the rain. It is also used for degree the strength of the rain. It has digital and analog production. The more water means lower output and less water means higher output.

Thing speak:
Thing speak is a release basis IOT app. It retrieves the data using HTTP code of behavior above the internet or local area network. It is used MATLAB software for math works.

4. Conclusion

The analysis of different papers on applications of smart cities application models have not discussed some of the major parameters e.g. reliability, network bandwidth, security etc. Most important one is security parameter as it concerns on data security and privacy of the users and application itself. When if someone is going to design his/her "Internet of Things" application of any kind then these parameters should be fulfilled. In future we will are going to discuss a list of parameters which should to taken under consideration when making the application.

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