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Internet of Things Technologies for Smart Towns: A Remote System for Making Town Smart

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ABSTRACT

A smart Town is an urban area that uses different types of electronic data collection sensors to supply information which is used to manage assets and resources efficiently and that excels in the area of economy, governance, people and life through strong human capital, social capital and Information and Communications Technology (ICT) infrastructure. It is a new approach to managing urban complexity, improving efficiency, reducing costs and improving citizens' quality of life. Nowadays The Internet of Things (IoT) is changing our working environment and everyday life. The Internet of Things (IoT) can integrate a large number of heterogeneous end systems transparently and seamlessly, while providing open access to selected subsets of data for the development of a multitude of digital services. In this project, we developed a smart Town system equipped with the Internet of Things. So our system will help to detect accidents, water pollution, automatic street lighting, reduce electricity wastage and video surveillance. It will lead to fully automated city services and make the lives of citizens easier and more convenient.

Keyword: *IoT; Smart Town; Technologies; ICT*

I. INTRODUCTION

The information world and related information technologies have made significant progress in the last two decades. This progress can be achieved and implemented from the Internet concept to the Internet of Things. The Internet of Things (IoT) is a recent communication paradigm in which the objects of everyday life are equipped with microcontrollers, digital communication transceivers and appropriate protocol stacks that allow them to communicate with each other and the users, becoming an integral part of the Internet [1]. The IoT concept aims to make the Internet even more immersive and pervasive. Furthermore, it also allows easy access and interaction with a variety of devices such as, home appliances, actuators, displays surveillance cameras, monitoring, sensors, vehicles, and so on, IoT will encourage the development of a number of applications using the potentially huge amount and variety of data generated providing new services to citizens, companies and public administrations. In many different domains, this paradigm finds application, such as, for instance home automation, industrial automation, medical aids, mobile healthcare, elderly assistance, intelligent energy management and smart grids, automotive, traffic management, and many others [2].

However, such a heterogeneous field of application makes the identification of solutions capable of meeting the requirements of all possible applications a great challenge. This difficulty has sometimes led to incompatible proposals for the practical realization of the IoT system. Therefore, from a system point of view, the realization of an IoT network and the required network backend services and devices, because of its novelty and complexity, the best practice still lacks. Besides the technical difficulties, the adoption of the IoT paradigm also hinders the lack of a clear and widely accepted business model which can attract investment in promoting the deployment of these technologies [3].

In this complex scenario, it is of particular interest to apply the IoT paradigm to an urban context, responding to the strong pressure of many national governments to adopt ICT solutions in public affairs management realizing the Smart City concept. Although there is still no formal and widely accepted definition of “Smart City, " the ultimate goal is to make better use of public resources and to increase

the quality of services offered to citizens, while reducing the public administration operating costs. This goal can be pursued through the deployment of an urban IoT, i.e., a communication infrastructure that provides unified, simple and cost-effective access to a variety of public services, so unleashing potential synergies and enhance citizens ' transparency. An urban IoT, In fact, there may be a number of advantages in the management and optimization of traditional public services, such as transport and parking, lighting, monitoring and maintenance of public areas, preservation of cultural heritage, garbage collection, hospital and school, Furthermore, the availability of various types of data, collected by a pervasive urban IoT, It can also be used to increase transparency and promote local government actions towards citizens, enhancing people's awareness of their city's status, stimulating citizens ' active participation in public administration management and also stimulating the creation of new services for those provided by the IoT. Therefore the application of the IoT paradigm to Smart City is particularly attractive for local and regional governments that may become the early adopters of such technologies, acting as catalysts for IoT paradigm adoption in a wider scale.

This project aims to implement services that support the smart city. The services that we are going to address are accident detection, street light control, water pollution detection, video surveillance and weather monitoring. These automated services will help make the Town Smart. Our aim is to implement services that support Smart City. These services fall into the domains of smart transport, smart health, ambient-assisted living, smart tourism and recreation, crime prevention and community safety, governance, monitoring and infrastructure, disaster management, environment management, refuse collection and sewer management, smart homes and smart energy. The rest of the paper is organized as follows. Section II provides an overview of services commonly associated with the vision of the smart city and that can be enabled by urban IoT deployment. We discuss the objectives of the paper in Section III. Section IV deals with the project scope .We discussed our proposed system diagram with various hardware components in section V. Software Interfaces components discuss in section VI. Section VII renders our implemented system architecture. Section VIII sees the expected result while section IX renders the Experimental results. Section X sees the applications of Internet of Things in various section of a Town. The paper ends up with conclusion and references in section XI and section XII respectively.

II. SMART TOWN: CONCEPT AND SERVICES

According to Pike Research on Smart Cities, the Smart City market is estimated at hundreds of billion dollars by 2020, with an annual spending reaching nearly 16 billion. This market derives from the synergy of key industry and service industries such as smart governance, smart mobility, smart services, smart buildings and smart environment. These sectors have also been considered in the Indian Smart Cities Mission (http://smartcities.gov.in) to define a ranking criterion that can be used to assess the level of “smartness” of Indian cities. However, the Smart City market has not really opened up for a number of political, technical and financial obstacles [4].

The main obstacle under the political dimension is the allocation of decision- making power to the various stakeholders. One way of removing this roadblock is to institutionalize the whole decision - making and execution process, concentrating the strategic planning and management of the smart city aspects into a single, dedicated department in the city. On the technical side, the most important issue is the non-interoperability of heterogeneous technologies used in urban and urban developments. In this regard, the IoT vision can become the building block to realize a unified urban scale ICT platform, thus unleashing the potential of the Smart City vision[5][6].

Finally, as regards the financial dimension, there is still a lack of a clear business model, although some initiative to fill this gap has recently been undertaken [7]. The situation is worsened by the adverse global economic situation that has led to a general fall in public services investment. This situation prevents the potentially huge Smart City market. One possible way out of this impasse is to develop services that combine social utility with a very clear return on investment, such as smart parking and smart buildings, and thus serve as catalysts for other value - added services [7].

III. OBJECTIVE

This project aims to implement services that support the smart city. The services that we are going to address are accident detection, street light control, water pollution detection, video surveillance and

weather monitoring. These automated services will help make the city smart [8].

Our aim is to implement services that support Smart City. The objective will be achieved by implementing the following objectives-

- Monitoring the weather condition with a smart Mobile Application.
- Reducing overall electricity wastage by controlling street lights.
- Provide faster accident detection by providing information to nearby hospitals and police stations via SMS.
- Theft detection through video surveillance.
- Reduce water body pollution by sensing water ingredients.
- Monitoring the pollution level with a smart Mobile Application.

IV. PROJECT SCOPE

The Internet of Things can be used in different domains such as Smart city, smart society, security, smart traffic system, smart vehicles, smart agriculture, Energy usage, distribution traffic flow and home automation. Our project covers smart city services such as accident detection, street lighting, water pollution detection, video surveillance and weather monitoring.

V. PROPOSED SYSTEM

Smart cities are places where information and communication technologies are used to solve citizens ' various problems. But a city can only be called smart if every city component is smart. It can be a citizen, a city government and government services that all must be smart [8].

Therefore, with all these things in mind, we have proposed a system that will assist in the proper use of the available city resources.

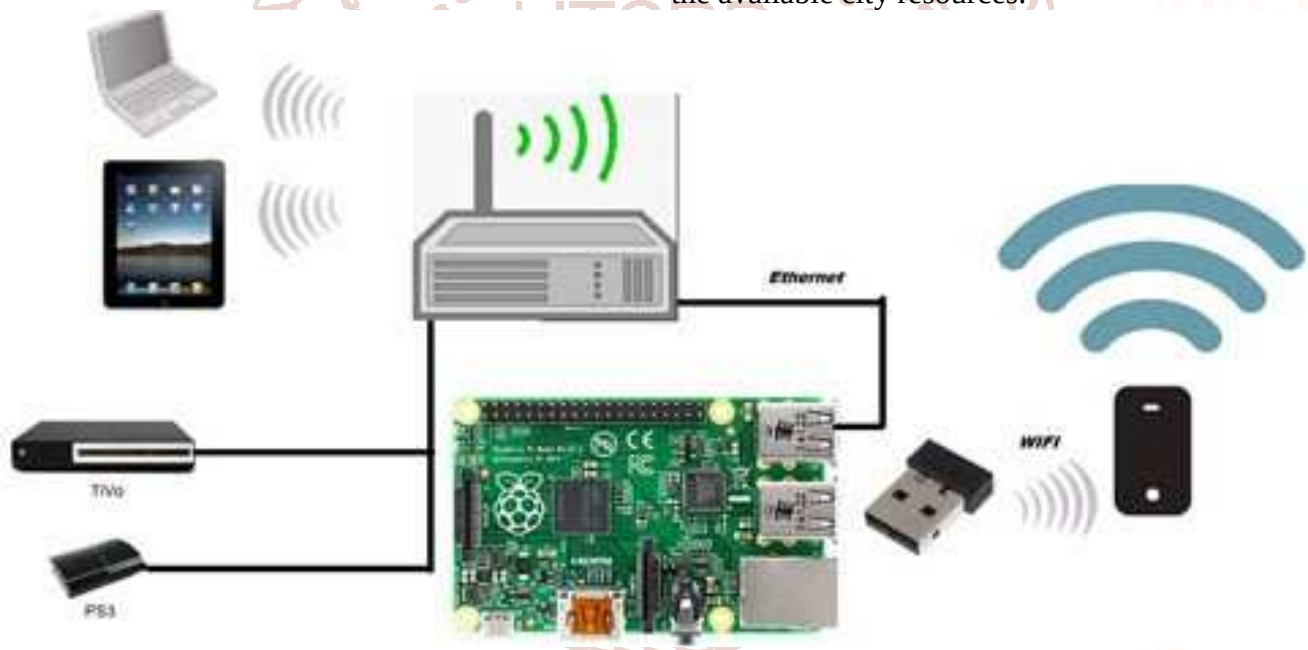

Fig.1. Proposed System

The various system components and their use are described below.

A. Raspberry Pi:

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing. In this project we have programmed it by using wiring pi library. [9]. All the sensors send their data to raspberry pi through a ADC and then the data is processed further.

B. Camera:

The camera is used to acquire electronic motion pictures so the system uses it for video surveillance. The camera captures the scenes and they are stored in the image format and we can use them to make videos whenever necessary.

C. Sensors:

The sensors are used to collect data from surrounding. They provide the environmental parameters like temperature, humidity, vibrations, noise/sound, light intensity etc. They require very less power for

working. The accuracy and reliability of sensors plays vital role in selecting a proper sensor for particular application.

D. Wi-fi Module:

The wi-fi module is used as interface between Raspberry pi and Server. We have used HLK-RM04 as wi-fi module in our system. It sends the data to android phone through the wireless media.

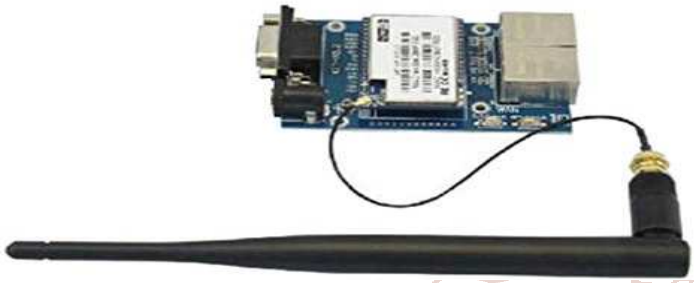

Fig.2 Hlk-rm04 Wifi Module

E. Relay Module

The relay module is used for real - time applications such as street lights. It acts as a switch to automatically switch devices when sensors exceed a certain threshold value. Market1-channel relay,2-channel relay,4-channel relay,8-channel relay, etc.

Fig.3 Relay Module Board

VI. SOFTWARE INTERFACES

F. JDK:

The Java Development Kit (JDK) is a software development environment used for developing Java applications and applets. We cannot debug our java applications without JDK installed in our system. There are different versions of JDK available for development.

G. Netbeans:

Netbeans is an open-source integrated development environment (IDE) for developing with Java, PHP, C++, and other programming languages. Net Beans is also referred to as a platform of modular components used for developing Java desktop applications.. Net beans is very good IDE for a beginner. We used Net beans for developing image grabber Server.

H. Android Studio:

Android studio is used for developing android application. It is an integrated environment that supports all the android libraries and functions. In android studio we can select the API level and accordingly design an .apk file of the android application.

I. Apache Tomcat:

Apache is a server that is used for deploying images captured by the camera. The images are then send to the android application for the service of citizens. The apache server is continuously running in background when system starts.

VII. IMPLEMENTED SYSTEM ARCHITECTURE

The system proposed is implemented as shown in the figure 1.

- Initially, all the connections are done from sensors to the raspberry pi. Then code is uploaded in the raspberry pi and a threshold value is set in the code.
- Then all the data obtained from the sensors is transfer to raspberry pi and pi will send that data to the server using wifi modem. And from server anyone can access the data if he/she has installed our android app in their android phone.
- One important system component is sensor. The sensor senses environmental data. The system consists of four different sensor types that gather information from four different City parameters.
- The information is in the form of values and the values are sent to the server, only action is taken by the server if those values exceed certain limit. So the system will give notification on to the client android application on the basis of the threshold value set in code. The overall system flow is shown in above figure 1. that is the flow graph for our system.

VIII. EXPECTED RESULT

- Automatic Switch on and turn off street lights depending on visibility.
- Video monitoring for the selected area and sending alerts to Android Mobile.

- Incident detection and transmission of information to the nearest police station and hospital.
- To inform citizens about changes in temperature by Android Mobiles.

IX. EXPERIMENTAL RESULT

The results are obtained from three different situations in which sensors each time perceive different values. We tested the system manually, so we vibrate the sensor manually and took three readings.

Sr. no.	Vibration sensor	Temperature sensor (LM35)	Infrared Sensor (IR)	LDR
1	56	53	42	30
2	58	55	44	35
3	254	59	200	46

X. APPLICATIONS

- Town Management and Economic development
- Street and traffic lights
- Transportation
- Parking
- Infrastructure and maintenance
- Waste management (including waste water)
- Air quality
- Crime
- Energy usage and distribution
- Traffic flow

XI. CONCLUSION

The system developed using the Internet of Thing will provide services such as automatic street light, video monitoring, weather report, waste management infrastructure and maintenance, etc. It will help to improve the use of available infrastructure facilities and thus provide a decent environment through the smart solutions. So IoT's use is the best way to make the city smart.

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