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Waste Management in IoT-Enabled Smart Cities

Ragula U

Department of Computer Science and Engineering, Mount Zion college of Engineering And Technology, Pudhukottai, Tamilnadu, India-622507

Abstract: ***The Web and Internet of Things (IoT) model is being enabled by the propagation of various devices like RFIDs, sensors, and actuators. In the present world, we see the dustbins are placed on the roadside and dustbin is over flowing. This overflow of dustbin is due to the increase in the population and the wastage from hotels, industries etc. This run over of dustbin will make our environment ugly and cause much disease to the public. To avoid this situation we planned to design Waste Management System Using IOT System. Smart devices (devices having significant computational capabilities, transforming them to 'smart things') are embedded in the environment to monitor and collect ambient information. In a city this leads to Smart City frameworks. Intelligent services could be offered on top of such information related to any aspect of humans' activities. A characteristic example of services offered in the framework of Smart Cities is IoT enabled waste management. Waste management involves not only the collection of the waste in the field but also the transport and disposal to the appropriate locations. This survey sets up the basis for delivering new models in the domain as it reveals the needs for defining novel framework for waste management.***

Keywords: Internet of Things, Smart Cities, Waste Management

1. Introduction

Now-a- days smart cities represents hot topic in terms of improving living conditions. The application of Smart City Waste Management in a city is a alarming challenge faced by the public administrations. Waste is define as any material in which something valuable is not being used or is not working and represent numberfinancial value to its owner the waste generator. Our work focuses on the optimization algorithms for Smart City management and more specifically this paper deals with municipal waste collection procedure. Nowadays, the garbage-truck needs to pick-up all garbage cans even if they are empty. To avoid such challenges faced we are proposing a system where efficient routes are defined shortest route to collect the garbage filled bins

The vast amount of earth population (i.e., 70%) will move to urban areas, thus, forming vast cities. Such cities require a smart sustainable infrastructure to manage citizens‟ needs and offer fundamental and more advanced services. The implementation of prospect Internet technologies improved by the use of the Internet Protocol (IP) on numerous wireless sensors enables the Internet of Things (IoT) paradigm. Numerous sensors have the opportunity to be part of Wireless Sensor Networks (WSNs). A definition of the concept of provided in A Smart City is a city well performing in a forward-looking way in the following fundamental components Smart Economy, Mobility Environment, Smart People, Smart Living, and Smart Governance, built on the smart combination of endowment and activities of self-decisive, independent and aware citizens. This explanation incorporates the fundamental component of a smart environment which is mainly adopted for system dealing with environmental pollution. This way, intelligent applications could be delivered on top of such infrastructures. WSNs are capable of reforming activities in a SC in every aspect of daily life. In this paper focus on a specific application domain, waste management. The efficient management of waste has a significant impact on the quality of life of citizens. The motivation is that waste disposal has a clear connection with negative impacts in the background and thus on citizen health.

2. Literature Survey

The Waste management in cities should be effectively and efficiently implemented. The various proposals were put forward and some of them are already implemented. But we cannot consider it as an effective one. This survey paper was done among different proposal and this includes survey among different methods for smart garbage management in cities using IoT. Discusses about the existing approache in the field of smart waste management.

Hong et.al [1] the proposed system was based on waste data level of garbage bins in metropolitan areas. The data was sent over the internet for analyzing and processing. Everyday new data was collected and on that basis the rate of waste level was calculated so as to predict the overflow of bins before. has optional that replacing SGSSmart Garbage Sensor instead of RFID waste collecting system helps to improve their energy efficiency up to 26% and can reduce the food waste decrease. Inside the SGS they have installed SGBs Smart Garbage Bins to control the energy efficiency of the system.

Pavel Masek et.al [2] has suggested that it provides end – to - end security and privacy that is built upon dynamic federation smart city platform. Its benefits are that it has good dependability and has resilience on failure of a system over a particular month. It focuses on the collection of wastages and accomplishment of ontology method.

Lozano Murciegoet.al [3] has suggested that to collect the dustbins that are been filled using a truck. The main advantage is that it reduces the fuel cost of the trucks rather than travelling a long distance it makes the path simpler and easier to reach the dustbin using route optimization.

Anagnostopoulos et.al [4] has suggested that it first starts with an assumption that the smart city must include the IoT base. It uses dynamic scheduling. It is based on the fact that

the garbage will be collected only when it is fully filled or the maximum capacities of the dustbins are filled.

Abarca Guerrero et.al [6] outlines the fact that the developing countries undergo a prominent factor of affecting the waste management systems due to rising population levels and rapidly growing urbanization. The collaborators of the waste management are many such as household, industry sectors, educational and research intuitions etc.

3. Proposed System

Internet of Things is nothing but the applications performing with the help of internet access. IoT Communication over the internet has grown from user - user interaction to device – device interactions these days. This concept was proposed years back but still it's in the initial stage of business exploitation. Home automation industry and transportation industries are seeing rapid growth with IoT. The main idea to design a smart wastage detection method which would automatically inform the official about the current status of various wastage bins in the city, would have real-time monitorcapability, which would be remotely controlled using IoT technique.

The main idea of our project involves applying IoT technology electronics and application to the current city waste management scenario and enables a two way communication between the infrastructures deployed in the city and the operators/administrators. A centralized system for real-time monitoring is our goal to achieve. In this way both the municipal benefit from an optimized organization which result in most important cost savings and less municipal pollution.

In this proposed system there are multiple dustbins located through the city or the campus, these dustbins are provided with low cost embedded device which helps in tracking the level of the garbage bins and an unique ID will be provided for every dustbin in the city so that it is easy to identify which garbage bin is fill. The level reaches the threshold limit, the device will transmit the level along with the unique ID provided. These details can be accessed by the concern authorities from their place with the help of internet and an immediate action can be made to clean the dustbins.

Figure 3.1: Today bin condition in the city

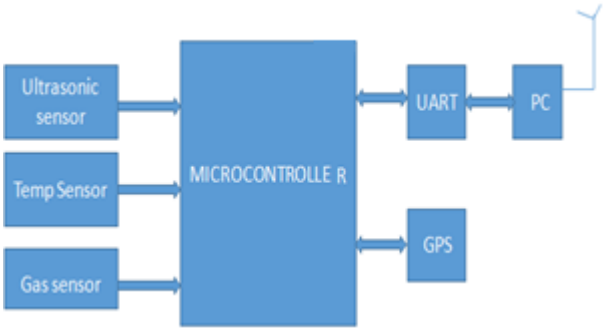

Figure 3.2: Block Diagram

4. Main Equipments Used in the Smart Waste Management System

1) Garbage Container

A waste container is a container for temporarily storing waste, and is usually made out of metal or plastic. The curbside dustbins usually consist of three types: trash cans (receptacles made of metal or plastic), dumpsters (large receptacles similar toskips) and wheelie bins (light, usually plastic bins that are mobile). All of these are emptied by collectors, who will load the contents into a garbage truck and drive it to a landfill, incinerator or consuming crush facility to

2) Ultrasonic Sensor

A special sonic transducer is used for the ultrasonic proximity sensors, which allows for alternate transmission and reception of sound waves. The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor. Ultrasonic sensors generate high-frequency sound waves and evaluate the echo which is received back by the sensor, measuring the time interval between sending the signal and receiving the echo to determine the distance to an object.

3) Arduino Board

Arduino is a software company, project, and user community that designs and manufactures computer open-source hardware, open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices [3]. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named Processing, which also supports the languages C and C++. The first Arduino was introduced in 2005, aiming to provide a low cost, easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner

hobbyists include simple robots, thermostats, and motion detectors

4) Software of Arduino

The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such assyntax highlighting, brace matching, and automatic indentation, and provides simple one-click mechanism to compile and load programs to an Arduino board. A program written with the IDE for Arduino is called a "sketch" [4]. The Arduino IDE supports the languages C and C++ using special rules to organize code.

5) GSM Module

GSM (Global System for Mobile Communications, originally Groupe Spécial Mobile), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used bymobile phones, first deployed in Finland in July 1991 [5]. As of 2014 it has become the default global standard for mobile communications - with over 90% market share, operating in over 219 countries and territories [6]. GSM networks operate in a number of different carrier frequency ranges (separated into GSM frequency ranges for 2G and UMTS frequency bands for 3G), with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead (for example in Canada and the United States). In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first generation systems.

6) Bread Board

A breadboard is a construction base for prototyping of electronics. Originally it was literally a bread board, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (AKA plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. "Breadboard" is also a synonym for "prototype". Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design. For this reason, solderless breadboards are also extremely popular with students and in technological education. Older breadboard types did not have this property. A stripboard (veroboard) and similar prototyping printed circuit boards, which are used to build semipermanent soldered prototypes or one-offs, cannot easily be reused. A variety of electronic systems may be prototyped by using breadboards, from small analog and digital circuits to complete central processing units (CPUs)

A modern solderless breadboard consists of a perforated block of plastic with numerous tin plated phosphor bronze or nickel silver alloy spring clips under the perforations. The clips are often called tie points or contact points. The number of tie points is often given in the specification of the breadboard. The spacing between the clips (lead pitch) is typically 0.1 in (2.54 mm). Integrated circuits (ICs) in dual in-line packages (DIPs) can be inserted to straddle the centerline of the block. Interconnecting wires and the leads of discrete components (such as capacitors, resistors, and inductors) can be inserted into the remaining free holes to complete the circuit. Where ICs are not used, discrete components and connecting wires may use any of the holes.

7) Jump Wires

Jump wires (also called jumper wires) for solderless bread boarding can be obtained in ready-to-use jump wire sets or can be manually manufactured. The latter can become tedious work for larger circuits. Readyto-use jump wires come in different qualities, some even with tiny plugs attached to the wire ends. Jump wire material for ready-made or homemade wires should usually be 22 AWG (0.33 mm2) solid copper, tin-plated wire - assuming no tiny plugs are to be attached to the wire ends. The wire ends should be stripped 3 ⁄16 to 5 ⁄16 in (4.8 to 7.9 mm). Shorter stripped wires might result in bad contact with the board's spring clips (insulation being caught in the springs). Longer stripped wires increase the likelihood of short-circuits on the board. Needle-nose pliers and tweezers are helpful when inserting or removing wires, particularly on crowded boards.

Differently colored wires and color-coding discipline are often adhered to for consistency. However, the number of available colors is typically far fewer than the number of signal types or paths. Typically, a few wire colors are reserved for the supply voltages and ground (e.g., red, blue, black), some are reserved for main signals, and the rest are simply used where convenient.

5. Conclusion

This survey paper is the implementation of smart garbage management system using IR sensor, microcontroller and Wi-Fi module. The objective of the paper is for the real time access of information about the dustbin. This waste Management System using IOT has implemented the management of waste in real time using smart dustbin to check the fill level of dustbin to check if it is full or not. The novel IOT based system for waste collection in smart city. Providing the service for the different kind of stake holder involved in this area. This system assure the cleaning of dustbin soon when the wastage level reaches its maximum. If the dustbin is not cleaned in specific time then the record is sent to the higher authority who can take appropriate action against the concerned contractor Therefore, the smart waste management system makes the waste garbage collection more resourceful. Such system are vulnerable to plundering of components in the system in different ways which needs to be worked on.

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