Literature Survey

IOT : Smart Waste Management System For Metropolitan Cities

SURVEY PAPER ON MUNICIPAL SOLID LIQUID BASED SMART WASTE MANAGEMENT SYSTEM- ZERO WASTE USING INTERNET OF THING

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Abstract

Rapid increase in population, has led to the improper waste management in cities resulting in increased pests and spreading of diseases. Nowadays, the Garbage Collecting Vehicle (GCV) collects the waste twice or thrice in aweek. So, the problem is over flowing of wastages on the roads. Hence, to overcome this limitation, in this paper a scheme on smart waste management using Wireless Sensor Networks (WSN) and IoT (Internet of Things) is proposed. The garbage bins are deployed with sensors and are networked together using WSN. The sensors deployed in the garbage bins collect the data for every determined interval. Once the threshold is reached, it raises a request to the GCA (Garbage Collector Agent). This agent collects the requests of all the filled vehicles and communicate using IoT framework. The experimental simulation is done in proteus tool. A hardware prototype is developed for the proposed framework.

Introduction

For thousands of years, analysis of the physical environment is something that humanity has been doing that includes variety of parameters such as measuring distance, time, temperature, etc.The communication and exchange of information in IoT, takes places to serve advances intelligent services to the users. With various sensors and communication technologies integrated together in the recent development inmobile devices has resulted in the rise of academic interests.There is a critical need for a flexible layered architecture as the IoT should be cable of interconnecting billions or trillions of heterogeneous objects through the Internet. There are number of proposed architectures, amongst which the basic model is a 3 layer architecture, which consists of the Application, Network and Perception

layer.However in the recent literature some other models have been proposed adding more abstraction to the IoTarchitecture.

Literature Survey

The garbage management in cities has to be effectively and efficiently implemented. The various proposals were put forward and some of them already implemented. But it cannot be considered as an effective one. So a survey was done among different proposals and this survey paper includes survey among different methods for smart garbage management in cities using IoT.

Smart Garbage Management in Smart Cities using IoT proposed a method as follows. The level of garbage in the dustbins is detected with the help of ultrasonic sensors system, and communicated to the authorized control room through GSM system. Arduino microcontroller is used to interface the sensor system with GSM system. A GUI is also developed to monitor the desired information related to the garbage for different selected locations. This will help to manage the garbage collection efficiently. Level detector consists of IR sensors which is used to detect the level of the garbage in the dustbin. The output of level detector is given to microcontroller. Four IR sensors are used to indicate the different levels of the amount of the garbage collected in the dustbin which is placed in public area. When the dustbin is filled up to the highest level, the output of fourth IR receiver becomes active low. This output is given to microcontroller to send the message to the Control room via GSM module. At receiver, control room is present where all the activities are managing. At receiver, control room is present where all the activities are managing. This system assures the cleaning of dustbins soon when the garbage 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. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduce the total number of trips of garbage collection vehicle and hence reduce the overall expenditure associated with the garbage collection. It ultimate helps to keep cleanness in the society. Therefore, the smart garbage management system makes the garbage collection more efficient.

A dustbin is interfaced with microcontroller based system having IR wireless systems along with central system showing current status of garbage, on mobile web

browser with html page by Wi-Fi. Hence the status will be updated on to the html page. There by to reduce human resources and efforts along with the enhancement of a smart city vision. Considering the need of modern technology, the smart garbage bin can expensive but considering the amount of dustbin needed in India, there for they used based sensors to reduce its cost and also make it efficient in applications. And at the sender side they used only a Wi-Fi module to send and receive data. But because of the use of weight sensor for detection of amount of garbage in dustbin. It will only detect the weight of waste; not how much level it is of. The message can be sent directly to the cleaning vehicle instead of the contractor's office. Thus garbage bins are managed.

A Geographical Information System (GIS) transportation model for solid waste collection that elaborates plans for waste storage, collection and disposal has been proposed in for the city of Asansol in India. An enhanced routing and scheduling waste collection model is proposed for the Eastern Finland, featuring the usage of a guided variable neighborhood thresholding metaheuristic. The aim of the research was to develop an optimal schedule for trucks on defined collection routes. The data from the bins are processed in the DSS and if it is correct it is sent to organizers of waste collection in this particular place and to the road police. The truck driver doesn't waste time for waiting, he/she goes to the next point and the route is dynamically recounted. When the problem is solved the system recounts the route for one of the available trucks and the waste from unlocked bin is collected.It is combined with dynamic routing algorithms to maximize the efficiency of waste collection.

It reviews the researches done on waste collection in developing countries from 2005 to 2011 and considers challenges for developing countries in waste collection sphere. The research focuses on determination the stakeholders actions/behavior and evaluation of influential factors defining their role in waste collection process.The models in the survey were tested on real data. Considering system approaches for solid waste collection in developing countries is presented. The research compares the history and the current practices, presented from 1960s to 2013. The output of the survey is drawing a conclusion that developing and implementing solid waste collection approaches in developing countries are of a great importance. The main issue is that waste collection does not include innovation that IoT can provide. Models do not use real time information of the waste collection, although some approaches use advanced scheduling and routing via exploiting modern ICT algorithms.Information about bins status was not considered as part of waste collection. All the reviewed surveys do not propose a model that will use IoT

technology for Smart Cities, though they consider different approaches for waste collection.

The paper proposed an advanced Decision Support System (DSS) for efficient waste collection in Smart Cities. The system incorporates a model for data sharing between truck drivers on real time in order to perform waste collection and dynamic route optimization. The system handles the case of ineffective waste collection in inaccessible areas within the Smart City. Surveillance cameras are incorporated for capturing the problematic areas and provide evidence to the authorities. The waste collection system aims to provide high quality of service to the citizens of a Smart City. System architecture aims to suit two main targets. First target is providing software as-a-service (SaaS) products for customers. Mainly, these customers are private companies that are involved in waste collection, owning waste trucks, organize work of drivers, get contracts from municipalities and pass wastes to recycling organizations or city dumps. Second main target is developing a system, which makes possible mutually beneficial communication between all the stakeholders involved in the chain of supplying goods and utilizing solid waste in smart city. This paper presented a novel cloud-based system for waste collection in smart cities. The system aims to provide services for different kind of stakeholders involved in this area - from city administrations to citizens. Still, the design focuses mostly on providing SaaS services to commercial waste management companies

Infrared sensor (IR sensor) is used which is a multipurpose sensor, which can detect the level of garbage. IR sensor emits the light, which is invisible to eye but the electronic components can detect it. It consists of IR transmitter and IR receiver. The output of IR sensor is acquired by The National Instruments myRIO-1900.It is an input output device which is portable and reconfigurable. USB acts as a connector between the NI myRIO-1900 and host computer. It has connectors A and B that acts as an expansion port and a connector C that act as amini-system port, they carry the signals and these signals are distinguished by different connector names. Sensorsenses level of the bin. The GUI gives the output of what level of garbage is filled. Sensor senses level of the bin.The graphical representation to access the output of the sensor is as shown below. It gives the output of what levelof garbage is filled. When the level in a bin is reached the threshold, the LED placed at the location of the binstarts blinking. When the blinking LED is clicked, a display opens showing the location of the bin, status of thebin, data and time when the bin gets filled, mobile number and the text to send to the concerned person. But thissystem does not ensure whether garbage is cleaned or not and transportation cost is another issue.

Kalsiwal Mansai proposed model of Garbage Management using Internet of Things for Smart Cities in organizing the garbage collection system of residential or commercial areas. In the proposed system, the level of waste material in the garbage bin has been detected with the help of ultrasonic sensor and it will continuously communicate to the authorized control room through GSM module. Micro-controller is used to interface the sensor system with GSM system. A GUI is also developed to supervise the desired information related to the garbage for various selected locations. The main feature that differs from other systems is that MATLAB based GUI. In this system there is a requirement of master and slave units. Slave unit is placed in the garbage bin likely wise master unit is placed at the control room. Slave unit consists of Arduino Uno board which has Atmega328 IC, ultrasonic sensor and GSM module. The entire circuit is placed at top of the dustbin. In ultrasonic sensor, the trigger pulse is continuously sent in the dustbin and echo pulse reflects back to ultrasonic sensor. Ultrasonic sensor continuously checks the garbage level in dustbin. Once the level of garbage reaches to specified threshold values, ultrasonic sensor gives indication to Arduino Uno board and through GSM, SMS will be send to control room which will indicate that the Please inform the cleaner of specific floor as the dustbin of that floor is full‖. In master unit when the SMS is received at control room, it will indicate on GUI the percentage of approximate garbage collection of that floor and it will automatically inform the cleaner of that floor.

Vishesh Kumar Kurrel assures the cleaning of dustbins soon when the garbage level reaches its maximum.In this management system IOT as the working in the field for networked radio-frequency identification (RFID),tracking the collection vehicle, Dustbin monitoring and other emerging sensing technologies. The IR sensor is act as level detector. The assures a low budget by changing all light traffic servers into Raspberry Pi. The sensor senses the content of the dustbin and sends the signals or the data to the ARM microcontroller then the microcontroller reads the data from the sensor and process the data received from sensor, and the same data will send to Dashboard section and this section send mail/message to respective Municipal / Government authority person or collection vehicle. 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. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection.

Conclusion

This survey has been performed for collecting the details of smart garbage management methods and to find out effective methods which are useful for providing hygiene environment in cities. As the level of garbage in the bins crossed the threshold, it will be informed to the corresponding authority, if it was found ignored then the details will be forwarded to the higher authority to take necessary actions. Thus a hygiene and clean environment can be provided. This survey helps in identifying all possible smart garbage management methods that can be implemented to make city clean.

References

[1] S.S. Navghane, M.S. Killedar, Dr.V.M. Rohokale,‖ IoT Based Garbage and Waste Collection Bin‖, May 2016.

[2] Guerrero, L.A., Maas, G., Hogland, ―W.: Solid waste management challenges for cities in developing countries. Journal of Waste Management.

[3] Alexey Medvedev, Petr Fedchenkov, ArkadyZaslavsky, Theodoros, Anagnostopoulos Sergey Khoruzhnikov,"Waste Management as an IoT-Enabled Service in Smart Cities".

[4] Kasliwal Manasi H., SuryawanshiSmitkumar B, "A Novel Approach to Garbage Management Using Internet of Things for Smart Cities".

[5] Monika K A, Nikitha Rao, Prapulla S B, Shobha G, "Smart Dustbin-An Efficient Garbage Monitoring System ".