**Internet of Things**

**Intellectual trash management using Internet of Things**

A Sathish, M Prakash, SAK Jainulabudeen, R Sathishkumar

2017 International Conference on Computation of Power, Energy Information and Commuincation (ICCPEIC), 053-057, 2017

Internet of Things

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Proper waste management is one of the major problems for densely populated urban areas. It is getting difficult day by day to lead a healthy, sustainable living in urban areas because of environmental contamination. Due to the lack of proper waste management approach, problems like an overflow of waste occurs that badly harm our environment. Polluted surroundings result in the spread of various kinds of diseases in an epidemic form. For developed and developing countries, waste management is a challenge to longterm development. Proper management of waste is getting tougher because of increasing population, urbanization, and industrialization. In this modern era of technology, we need to apply technology-based solutions to handle large amounts of waste for overpopulated urban areas. We have reviewed several recent research articles related to the smart waste management system, and almost all of them have some major limitations as well as progress. To ensure environmental hygiene and sustainable urban life, we have presented a smart IoT based integrated system consists of an identification system, an automated lid system, a display system, and a communication system. Arduino Uno is used as a microcontroller to synchronize all of the four systems. Sensors are used for identification and measuring the garbage level. The system provides the facility of continuous monitoring of the status of waste inside the garbage bin and shows the percentage filled up on liquid crystal display (LCD). The communication system uses a global system for mobile communications (GSM) module that will inform the corresponding authority to collect the waste when the garbage bin is filled up. The proposed waste management system is much more efficient than any other conventional waste management system as it reduces the use of manpower, avoids spillover of waste, saves time, more economical, and most importantly it is a completely automated system.

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Population is growing day by day so the atmosphere is compelled to be clean and hygiene. In most of the regions, the flooded trash bins are generating unsanitary surroundings. It's very important to line out the day to day wastes in nursing economical and straightforward manner. Lack of trash bins wastage supervision can outcome in disruption of the environmental balance and in turn lands up in the degradation of the health and hygiene society. The foremost drawbacks that have arisen deals with the detection, observation, and management of wastes. The present methodology of observing the waste system might be a sophisticated and arduous method that wants countless individual effort, rice and thus will not be well-suited with the enlargement in the technologies. Existing System has edges besides, has disadvantages. We tend to propose an Intelligent Trash Management in smart Cities using IoT. Once the rubbish reaches the extent of the trash bins, then that indication is given to Smartphone's through Android application by Arduino UNO. The controller will give an indication to the trash collecting truck. That garbage bin is completely crammed and needs imperative attention. This might facilitate to manage the rubbish assortment with efficiency.

**Solid waste collection as a service using IoT-solution for smart cities**

Sangita S Chaudhari, Varsha Y Bhole

2018 International Conference on Smart City and Emerging Technology (ICSCET), 1-5, 2018

There has been tremendous increase in solid waste generation in last few years. Solid waste management is a key and challenging issue of environment in the whole world. Hence, there is a need to develop an efficient system which can eliminate this problem or at least reduce it to the minimum level. In today's era, every government across the globe is planning to build smart cities or try to transform existing cities into smart cities. Collection of solid waste is a crucial point for environment and its impact on society should be considered seriously in smart cities infrastructure. Internet of Things (IoT) technologies can efficiently handle such services in smart cities. In this paper, we are proposing an IoT based solid waste management system which enables garbage bin monitoring, dynamic scheduling and routing of garbage collector trucks in a smart city. In the proposed system, garbage bins equipped with low cost embedded device are located at various places in entire city. Real time status of garbage level along with garbage bin location is sent to cloud. We have designed a cloud based system for organizing solid waste management process and mobile application for waste collection drivers and Municipal Corporation to monitor and control solid waste collection as a service. Mobile application facilitates the waste collection drivers to go to the garbage bins using dynamic and shortest route.

**IoT based smart garbage detection system**

Abhishek Dev, Maneesh Jasrotia, Muzammil Nadaf, Rushabh Shah

Int. Res. J. Eng. Technol 3, 12, 2016

Owing to a paradigm shift toward Internet of Things (IoT), researches into IoT services have been Qconducted in a wide range of fields. As a major application field of IoT, waste management has become one such issue. The absence of efficient waste management has caused serious environmental problems and cost issues. We here propose a probable solution to this problem for urban cities. Using IoT technologies for waste management is one probable solution that we have proposed through our work. We explain our idea with the help of a simulation model. This model consists of an Arduino controller, a few garbage bins loaded with sensors and they are monitored continuously through a web. This system also has a scope for citizen participation, wherein any grievances from citizens related to waste management is heard.

**Implementation of IoT based waste segregation and collection system**

Bhupendra Fataniya, Aayush Sood, Deepti Poddar, Dhaval Shah

International Journal of Electronics and Telecommunications 65, 2019

Waste management is a challenging problem for most of the countries. The current waste segregation and the collection method are not efficient and cost-effective. In this paper, a prototype is presented for smart waste management. It is also capable of waste segregation at the ground level and providing real-time data to the administrator. Impact and cost analysis of the deployment of smartbin is also presented considering one ward of Ahmedabad Municipal Corporation. It is clear from that deployment of this smartbin will save about 40% of the current expenditure for that ward.

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IoT enabled waste management system using ZigBee network

S Karthikeyan, G Sheela Rani, M Sridevi, PTV Bhuvaneswari

2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), 2182-2187, 2017

With rapid urbanization, industrialization and population growth in India, solid waste management is becoming the key challenge for state governments and local municipal bodies. The garbage containers that are placed at public places are found to be overflowing frequently due to increase in the daily waste disposal. In this research, IoT (Internet of Things) enabled waste management system using ZigBee network and MQTT (Message Queue Telemetry Transport) protocol is proposed to determine filled status of the garbage container. The data acquisition module placed within the container updates the server via ZigBee coordinator, whenever the level of the garbage reaches the threshold. MQTT is a lightweight protocol and it provides the communication link between coordinator and the server. Optimal path for collecting the filled containers is determined in the server using Haversine formula and travelling salesman algorithm. The information is intimated to the garbage collection unit through Telegram messaging application to minimize time and fuel cost.

**Location based garbage management system with iot for smart city**

Shashika Lokuliyana, Anuradha Jayakody, GSB Dabarera, RKR Ranaweera, PGDM Perera, PADVR Panangala

2018 13th International Conference on Computer Science & Education (ICCSE), 1-5, 2018

Smart cities integrate multiple ICT and IOT solutions to build a comfortable human habitation. One of these solutions is to provide an environmentally friendly, efficient and effective garbage management system. The current garbage collection system includes routine garbage trucks doing rounds daily or weekly, which not only doesn't cover every zone of the city but is a completely inefficient use of government resources. This paper proposes a cost-effective IOT based system for the government to utilize available resources to efficiently manage the overwhelming amounts of garbage collected each day, while also providing a better solution for the inconvenience of garbage disposal for the citizens. This is done by a network of smart bins which integrates cloud-based techniques to monitor and analyze data collected to provide predictive routes generated through algorithms for garbage trucks. An android app is developed for the workforce and the citizens, which primarily provides the generated routes for the workforce and finds the nearest available smart bin for citizens.

**Smart trash: An efficient way for monitoring solid waste management**

Ujwala Ravale, Anindita Khade, Namrata Patel, Suvarna Chaure

2017 International Conference on Current Trends in Computer, Electrical, Electronics and Communication (CTCEEC), 1135-1137, 2017

Solid waste management is primary issue in modern cities due to increase population, change in our lifestyle and increased in number of industries. As we have seen number of times the dustbins get overflowed and the concerned people don't get the information within a time and due to which filthy condition formed around the surroundings, at the same time bad smell spread out due to waste, bad look of the city which paves the way for air pollution and to some harmful diseases around the locality which is easily spreadable. It creates unhygienic condition for the people and creates bad ugliness around the surroundings. This leads in spreading some deadly diseases & human illness, to avoid such a situation we are planning to design Solid Waste Management using Smart Bin. This will help to provide a better standard of living for people. Also the waste generated can be forwarded to recycling centers as well as biodegradation centers according to the type of waste.The major advantage of this proposed system is it will stop the dustbin overflowing around the road side and localities as smart bins are used in real time.

**Smart solid waste management**

Ravi Kishore Kodali, Venkata Sundeep Kumar Gorantla

2017 3rd International Conference on Applied and Theoretical Computing and Communication Technology (iCATccT), 200-204, 2017

The rapid growth in the population automatically demands better infrastructure and more facilities. Employment and attaining balance in economy is an important concern for a nation having such rapid increase in its population, which finally results into evolution of new urban areas and cities. A smart city is created upon various particular components and strong waste administration is one of these crucial viewpoints. For example, today, to address the rising issue of carbon emissions in construction process, contractual workers are obligatorily made a request to use supplies according certain standards. Subsequently, to employ such operational standards we need dynamic investment and acknowledgment from the workers in using equipment according to the endorsed technologies. Essentially, the adequacy of strong waste administration framework relies on the involvement of the considerable number of stakeholders and natives. Strong waste administration is of grave significance to a urbanized locale which confronts the consistent growth in population, rising infrastructural requests and extending inflow of migrants. Understanding the idea and setting of waste isolation is additionally a key segment in the strong waste administration handle. This is the phase where India still lingers behind as against the universal partners. In a nation like Finland, just around 7 percent of the waste gets arranged into the dumping yard and the staying around 93 percent of the waste segment is reused. This level of adequacy in actualizing the strong waste administration framework is possible just because of subjective spread of civic sense, clear understanding and acknowledgment over the idea of waste segregation.

**A survey of smart environment conservation and protection for waste management**

E Ramya, R Sasikumar

2017 Third International Conference on Advances in Electrical, Electronics, Information, Communication and Bio-Informatics (AEEICB), 242-245, 2017

In many areas, the municipal garbage bins are overflowing and get down some places they are not cleaned at proper time in garbage bin, if the garbage bin is overflowed it's defects is spread pollution and people affect disease. In this paper to propose a smart garbage bin, once if it fill the garbage bin it will send the notification to authorized person by using a GSM then the garbage is dumped into waste land.

**IoT based smart garbage collector for smart cities**

MN Rajaprabha, P Jayalakshmi, R Vijay Anand, N Asha

International Journal of Civil Engineering and Technology 9 (12), 435-439, 2018

Smart cities are the emerging cities that provide essential services for people to have a comfort and quality life. These cities are designed using various sustainable practices. Increase in the population and the essence of comfortable living gave a tremendous growth in the urban areas which results in the generation of huge amount of solid wastes. Improper disposal mechanism leads to pollute the land, water and air. To avoid such a situation and to improve the cleaning,‘IoT based smart garbage collector’is proposed. In this paper we propose a garbage collector which makes use of the technologies like IoT and Cloud Storage for efficient solid waste management in smart cities.

**IOT Smart garbage monitoring system in cities-An effective way to promote smart city**

Palaghat Yaswanth Sai

International Journal of Advanced Research in Computer Science and Software Engineering 7 (2), 99-102, 2017

This is a very innovative system which will help to keep the cities clean. In the recent decades, Urbanization has increased tremendously. At the same phase there is an increase in waste production. Waste management has been a crucial issue to be considered. This system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this the system uses waterproof ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth. smart bin is built …