**Smart and Green Urban Solid Garbage Collection Systems using IoT**

**Abstract**

The new era of Web and Internet of Things (IoT) paradigm is being enabled by the proliferation of various devices like RFIDs, sensors, and actuators. 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 typical 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. In this paper, we present a comprehensive and thorough survey of ICT-enabled waste management models. Specifically, we focus on the adoption of smart devices as a key enabling technology in contemporary waste management. We report on the strengths and weaknesses of various models to reveal their characteristics. 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.

**Existing System**

* At present, there is no collection and disposal mechanism. The figure below shows the current waste generation and the present methods used for disposal of the waste.
* The city does not have any infrastructure to collect and transport the waste and there is no specified location for the waste disposal.
* Majority of the respondents dump their biodegradable waste (68.04%) and nonbiodegradable (67.71%) waste in dustbins which is ultimately thrown in the open fields.
* A very less proportion of households (1.48%) dispose bio-degradable waste in a safe manner.
* Safe disposal of bio-degradable waste includes disposing solid waste in an identified place, composting, burying, re-using in the garden and having the GP collect the waste and feeding it to the cattle.
* As far as the volume of waste generated is concerned, there is no specific measured data that is available.
* The national waste generation average can be taken as a basis for designing a management solution for solid waste disposed from the area.

**Proposed System**

* We propose a smart waste collection system on the basis of level of wastes present in the wastebins.
* The data obtained through sensors is transmitted over the Internet to a server for storage and processing mechanisms.
* Sensors: We can determine the waste level by measuring the distance from the top of the trashbin to the waste bysonar.
* Sensing and data forwarding rates, and wireless technology used have a strong influence on energy consumption. Collection and forwarding of datacan be done once or twice in a day.
* It is used for monitoring the daily selection of wastebins, based on which the routes to pick several of the wastebins from different locations are decided.
* Predict future state with respect to factors like traffic congestion in an area where the wastebins are placed, cost-efficiency balance, and other factors that is difficult for humans to observe and analyze.
* It can be predicted before the overflow of wastes occurs in the wastebins that are placed in a specific location.
* Depending on economic requirements specified at early stages, the optimized selection of wastebins to be collected is expected

**HARDWARE REQUIREMENTS:**

* Power supply
* CO sensor
* Noise Sensor
* Moisture & Humidity Sensor
* Infra-Red Sensors for wastebins
* Temperature sensor
* Smell sensor
* Microcontroller
* Bluetooth
* MAX232/RS232
* IOT Device (GPRS Modem)
* Driver Circuit (ULN2003a)
* Relay
* Load
* LCD Display

**SOFTWARE REQUIREMENTS:**

* Embedded C
* JAVA
* MPLAB IDE
* Eclipse IDE

**ARCHITECTURE**



**Literature Survey**

**Environmental informatics for solid and hazardous waste management: Advances, challenges, and perspectives**

**Author : J.-W. Lu, N.-B. Chang, and L. Liao**

**Publication year : 2013.**

Environmental informatics has experienced extraordinarily rapid progress in the past decade and has made an invaluable contribution to planning, design, and operations for waste management. In many cases, however, the roles of these information technologies have been limited to stand-alone projects without synergistic effects. This article presents a holistic view and an in-depth discussion of environmental informatics applied to solid and hazardous waste management from the onset to the present status, and to future trends aiming to advance the management potential. With regard to building, maintaining, and developing knowledge-based or artificial intelligence systems, the spectrum of environmental informatics for solid and hazardous waste management can be classified into five categories: database system, geographical information system, decision support system, expert system, and integrated environmental information system. Supporting technologies in the integrated environmental information system can be further divided into five classes in a logical order to enhance understanding: data acquisition, data communication, data and knowledge storage, data mining and knowledge discovery, and data and knowledge utilization. This critical review article may help create sustainable development strategies from a local solution to global opportunities that will elevate environmental informatics to a new level in dealing with more complex problems and large-scale applications for integrated solid and hazardous waste management.

**Design and development waste management system in Hong Kong**

**Author: C. K. M. Lee and T. Wu**

**Publication year: 2014**

Effective waste management is crucial for a metropolitan like Hong Kong and the latest technology such as RFID and data mining technique can help provide a sustainable waste management by analyzing the waste disposal habit. To have an integrated information system, the purpose of this paper is to adopt NFC and cloud computing technology to develop a Web-based system and mobile app for supporting waste management. A prototype system with ubiquitous technology is being designed and a pilot test of the RFID-based waste management system was launched in Homantin Student Hall of The Hong Kong Polytechnic University and the results showed that this RFID-based waste management system improved the recycling rate. The significance of the paper is to provide a novel approach by incorporating RFID and mobile app technology for waste management and it can arouse the public awareness about the importance of waste sorting for recycling and waste minimization.

**Optimizing municipal solid waste collection using chaotic particle swarm optimization in GIS based environments**

**Author: L. H. Son**

**Publication year: 2014**

Municipal Solid Waste (MSW) is an increasing concern at any municipality in the world, and is one of the primary factors that contribute greatly to the rising of climate change and global warming. MSW collection and disposal especially in the context of developing countries are indeed the urgent requirements for the sustainable development of environment and landscape, which rule over the quality-of-life and life expectancy of human being. In this paper, we concentrate on MSW collection at Danang city, which is one of four largest municipalities in Vietnam having high quantity of the average waste load per person and is bearing negative impacts of climate change such as severe weather conditions and natural disasters as a result. A novel vehicle routing model for the MSW collection problem at Danang city is presented. A novel hybrid method between Chaotic Particle Swarm Optimization and ArcGIS is proposed to generate optimal solutions from the vehicle routing model of Danang. Experimental results on the real dataset of Danang show that the proposed hybrid method obtains better total collected waste quantity than the relevant ones including the manual MSW collection procedure that is currently applied at this city.

**Impact of source segregation intensity of solid waste on fuel consumption and collection costs**

**Author : F. Di Maria and C. Micale**

**Publication year : 2013**

Life cycle assessment was used to evaluate different options for managing the organic fraction (OF) of municipal solid waste at source segregation (SS) intensities of 25% and 52%. Incineration was shown to be the best management option for processing the OF remaining in the residual waste. Aerobic treatment alone or combined with anaerobic digestion (AD) for recycling/recovering the SSOF led to relevant environmental impact reduction. The sensitivity analysis performed by adopting several energetic mixes from different EU areas showed that incineration gave lower environmental benefits when the amount of renewable energy of the mix was greater than 50%. For SS=52% benefits due to AD were negligible if the amount of renewable energy in the mix was greater than 30%.

**Modules Description**

**Sensors Architecture**

Power supply is used to supply the overall power to the sensors and microcontroller. Read the values from the sensors such as Moisture sensor, Humidity sensor, CO sensor, pressure sensor, smoke sensor and using microcontroller. Moisture sensor used to detect the liquid wastages Humidity sensor used to detect the solid wastages CO sensor used to detect Emissions

**Garbage Classification:**

This system a dry waste a wet waste separately for that we are using a moisture sensor if that sensor detected then the cap will open for dry waste.

**Dustbin level detection:**

We propose a smart garbage bin using cloud IOT based controller to identify when the garbage bin is being fill using level sensor we can get the volume occupied and left in the smart garbage bin. level sensors provide information on an absolute position of target or moving object .For glossy surfaces, transparent objects or in environments with high degree of dust and humidity,

**Information Sending:**

If the volume is full then the program triggers and alert message through IOT and sends an alert and location of the bin to collect the garbage‘s. The garbage collector collects the waste and empties the bin for info sending we will use a IOT Environment.