Smart Movable Dustbin

Raghavendra Rao[1], G Manjula [2]
shubham.r.naik[3],ravikiran[4],shivamma[5],ramya r[6]
[1,2]Assistant professor of CSE department ,Sri Sairam college of Engineering,
Bangalore

Abstract
This paper presents IoT innovation project of a smart waste bin with real time monitoring system.which integrates multiple technologiessuch as solarsystem, sensors and wireless communication technologies and machine frame work . The aim of this project is to provide an efficient and cost-effective and smart waste collection and disposal system hence providing clean, healthy and green environment. This study proposed a new framework that enables remote monitoring of solid waste bin in real-time via gsm to assist the waste management activity. The system framework is based on wireless sensor network [WSN] contains three segments renewable energy source, WSN and control station. Within this framework there are four developed subsystems: solar power system, smart waste bin, short messaging service [SMS] notification system and real-time monitoring system that are interrelated to each other to perform as an efficient, cost-effective waste management system that yield to a green and healthy living environment. The main idea behind this is to create a user friendly waste collection and disposal system that automatically triggers the dustbin when its full and auto dispose the waste at a particular point . with the help of autodisposal the smart dustbin makes less human effort and less garbage collection to a particular place and hence reduces the health risk.

Keywords: IoT, solid waste management; wireless sensor network;
Arduino, ultrasonic; PIR motion sensor; ESP8266 Wi-Fi
module; smart waste bin GSM/GPRS
module, solar panel, auto disposal frame.

Introduction

Due to the fast pace of urbanization, waste management is becoming a bigger issue each day in each developed and developing countries. In india, rapid urbanization and industrialization transition have changed the solid waste characteristics. The generation of municipal solid waste over the past 10 years has increased by 95 per cent due to rapid development in the urban areas . The waste created

from various sources will be lead to environmental pollution arising without an effective and well- organized solid waste management. Besides, this can also bring to serious health hazard and lead to the spread of infectious diseases. An effective solid waste management practices need to be updated to suit the current waste quantity and composition. ..The Internet of Things, also called The Internet of Objects, refers to a wireless network between objects. Usually the network will be wireless and self configuring, such as household appliancesystem able to alert the collector only the waste bin requires to be emptied. Thus, this able to optimize collection routing and save time and fuel. A system that able to collect and analyze data are important as a decision support tool to help the local authority or waste management contractor to improve their service. This paper proposed a new framework for waste management system. The designed framework comprises of three main parts: solar power system, smart waste bin and control station with SMS notification system andreal-time monitoring system. Smart waste bin uses WSNs to collect waste bin status and transmit waste bin information wirelessly to the mobilephone. The Internet of Things, also called The Internet of Objects, refers to a wireless network between objects. Usually the network will be wireless and self configuring, such as household appliances. Internet of Things refers to the concept that the Internet is no longer just a global network for people to communicate with one another using computers, but it is also a platform for devices to communicate electronically with the world around them. The Internet of Things (IOT) is the network of physical objects—devices, vehicles, buildings and other items which are embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data. The Internet of Things allows objects to be sensed and controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit

Literature Review

Several solutions for waste management equipped with IoT facili- ties have been proposed and invented in the literature to help solid waste management authorities improve the quality of service de- livery. An inevitable consequence of development and industrial progress is generation of waste. Therefore, efficient waste management is a matter of international concern and countries have setup robust regulatory waste management regimes for balancing the objectives of development and environment sustainability. In India, the national environment policy, 2006 while suggesting measures for collection of wastes and safe disposal of residues [7]. The metro cities and major economic hubs generate the maximum volume of waste, but a survey of 20 smaller cities selected to be developed as smart cities show that most are struggling to manage waste. So, there should be an improvement in the waste management techniques.

Paper-1

Smart Bin Implementation for Smart Cities

Authors: Narayan Sharma, Nirman Singha,Tanmoy Dutta

This paper, presented a proposed system for Smart Bin Implementation for Smart Citiesm. This paper describes the application of our model of “Smart Bin” in managing the waste collection system of an entire city. The network of sensors enabled smart bins connected through the cellular network generates a large amount of data, which is further analyzed and visualized at real time to gain insights about the status of waste around the city. This paper also aims at encouraging further research in the topic of waste management

Paper-2

Smart Dustbins with GSM and ARDUINO Module

Authors:Md Aamir Enam1 , Sarfaraj Khan2 ,Barsha Singh3 , Neha Kumari4

Everywhere people are investigating on different aspects in several fields for making smart cities to enhance civilization and human comfort. This paper presents some basic ideas on smart dustbin which can be helpful to reduce human effort to make waste management more efficient. It will sense that dustbin is full or empty and will instruct to dump the garbage by for sending messages by Gsm and arduino module controls.

Methodology

Bangladesh government has taken on the application of digital technologies and committed to make Digital Bangladesh by 2021. Within this time another goal is to be a middle-income country with peace, prosperity and dignity by help of technologies. As a result, the government of Bangladesh proposed a large number of projects relating to smart and digital technologies such as Online transaction and payment infrastructure, promotion of e-Business and commerce, High-tech Park, Human resource development, building e-Learning infrastructure, ICT-based education, e-Administration infrastructure, e-Citizen services, m-Governance services, Healthcare services, Agriculture services, Effective and efficient social security, Environment services. Some of those initiative is already taken and some are in queue (Hasanuzzaman Zaman and Rokonuzzaman, n.d.) (Rahman, 2015). As a part of the sustainable environment development and making Dhaka city greener, DCC have been technologically developed for collecting waste such as improved waste container, van, trucks, bulldozer etc. Bangladesh Government even has a plan to establish a Waste to Energy Plant as soon as possible. The plant will use the waste as substitute of coal and it will use 2000 tons of domestic waste from City Corporations' every day collection (S M Alauddin 31 October, 2015).

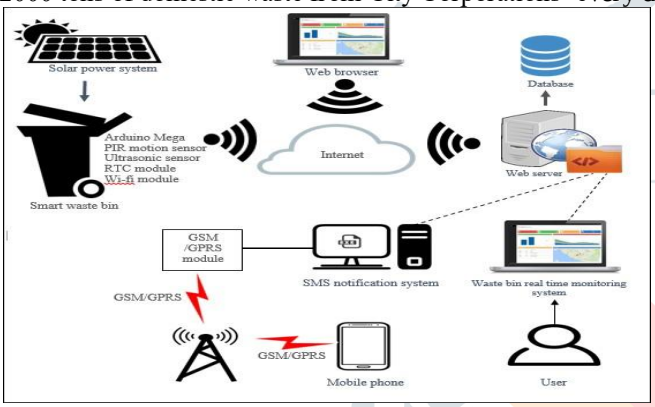

Fig. 1: System framework

3.1 Renewable Energy Source

In this segment, a solar power system is built by assembling three components: solar panel, solar charger controller and rechargeable battery. Solar panel absorbs the solar energy and converts it into electricity energy. The SR-HM solar charger controller is placed between a solar panel and a PROLiNK 12V 1.8AH rechargeable battery to regulate the amount of charge coming from the panel that flows into the deep cycle battery bank to avoid the battery being overcharged. The solar charger controller also provides a direct connection to the sensor system while continuing to re- charge the battery. Solar energy is the cleanest and most available renewable energy source. Figure 2 shows the block diagram of implemented solar power system

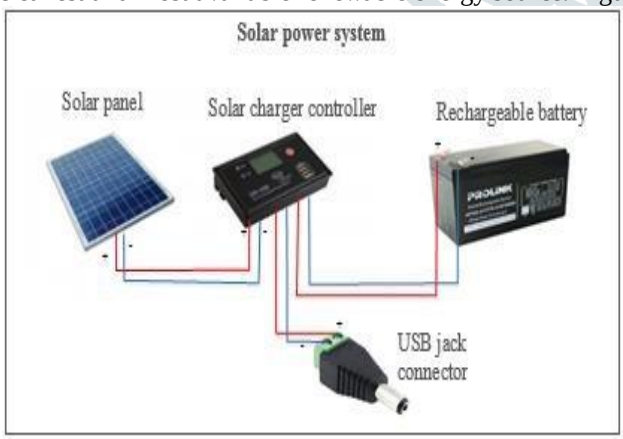

Fig. 2: Solar power system

3.2.PROBLEM IDENTIFICATION

Problem Statement:

Ordinary bins which we already have in our roads are cheap, light weight and easy to install. However, it isn't technologically smart enough. The whole structure is made by metal with a bin and a cover on top. Bin is flexible to collect the garbage while the cover on it is protecting the bin's garbage from rain water and birds. There are two types of garbage bins currently we have in our city one is bigger in size and another is little bit smaller. Garbage management workers collect the garbage from the bin after 7:00 PM every day (Alam, 2016). These ordinary bins have some issues. Conscious citizen faces problem when they can't find the nearest bin and the problem increases when if they found it may be broken or stolen (Rahman, 2016)(Figure 1). It is also not possible to track the fullness of bin automatically and there is no easy way to notify its responsible worker to collect

it and make it free again. If the citizen find the bin broken or stolen, then there is no easy way to notify responsible worker to fix it or rebuild it. If we consider developed

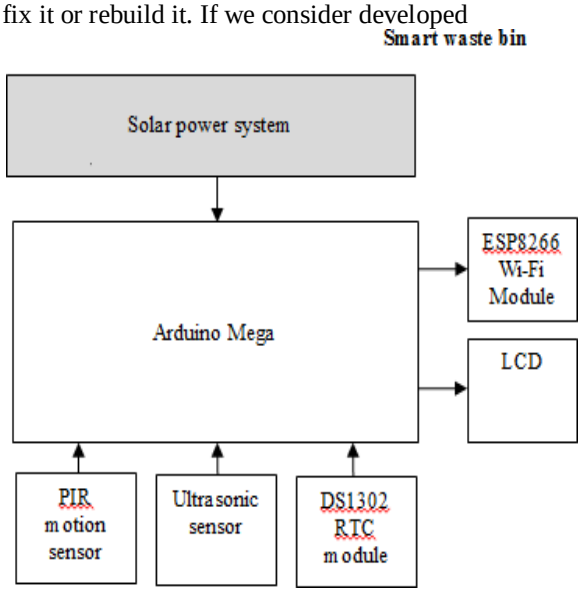

Fig. 3: Smart waste bin block diagram

Table 1: Waste bin fill-level indicators.

Indicator	Threshold	Value	Description
Status	0%	0	Empty/Not full
	>= 80%	1	Full

Table 2: Waste bin SMS notification indicators.

Indicator	Value	Description
sms	NS	SMS not sent
	S	SMS is sent

Table 3: Waste bin conditions.

Condition	Indicator		Description
	status	sms	
1	0	S	Initial or empty
2	1	NS	Full and notified
3	1	S	Full and not notified

Control station

The control station contains the central server which hosts the web server, database, SMS notification system in Figure 4 and a web- based waste bin real time monitoring system in Figure 5. The data sent by the smart waste bin is received by the control station and stored in the database server. Control station runs two systems which handle different jobs. The systems are SMS notification system and web-based was bin monitoring system.

SMS Notification System

This is a remote application that is developed in JAVA. To do its job, this application requires a computer that is directly connected to external GSM/GPRS SIM900A module. SMS notification sys- tem is daemon program which is configured to continuously query for waste bin with condition 2 together with garbage collector information [user id, name and mobile phone number] for every 1 seconds, send SMS to the respective garbage collector then update the waste bin data to condition 3.

APPLICATION

Less time and fuel consumption as the trucks go only to the filled containers.

Decreased noise, traffic flow and air pollution as a result of less trucks on the roads.

Our smart operating system enable two way communication between the dustbin deployed in the city and service operator. Therefore the focus is only on collection of route based fill level of the containers.

The sensors installed in the containers provide real time information on the fill level. This information helps determine when and where to prioritise collection.

In this way both service providers and citizens benefit from an optimized system which results in major cost savings and less urban pollution.

Reduces the infrastructure (trucks, containers), operating (fuel) and maintenance costs of the service by upto 30%.

Applying this technology to the city optimises management, resources and costs, and makes it a “SMART CITY”.

Historical information on collections helps adapt the deployment of containers to the actual needs of the city, therefore reducing the number of containers that clutter up the road and increasing public parking spaces.

It keeps the surroundings clean and green, free from bad odour of wastes, emphasizes on healthy environment and keep cities more beautiful.

Reducing manpower required to handle the garbage collection.

Fig. 4: Sensors attached at the waste bin lid.

Conclusion

This paper presents a framework of IoT innovation project for waste management system. This novel solution able to enrich the efficiency of waste bin collection activities and cost reduction. This project work is the implementation of Automatic Garbage Fill Alerting system using Ultrasonic sensor, Arduino Uno, Buzzer and Wi-Fi module. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. It will take power supply with the help of Piezoelectric Device .If the dustbin is not cleaned in specific time,

37 then the record is sent to the Sweeper or 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. It ultimately helps to keep cleanliness in the society. Therefore, the Automatic Garbage Fill Alerting system makes the garbage collection more efficient.predict future operation requirements and plan for better service todeliver.

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