IoT Based Smart Waste Management System for Smart City

[1]Sneha Patil, [2]Snehal Mohite, [3]Aishwarya Patil, [4]Dr. S.D.Joshi
[1, 2, 3] UG Student, [4] Professor
[1, 2, 3, 4] Department of Computer Engineering, Bharati Vidhyapeeth College of Engineering, Pune, Maharashtra, India

Abstract—A big challenge in the urban cities is that of waste management as there is a rapid growth in the rate of urbanization and thus there is a need of sustainable urban development plans. As the concept of smart cities is very much trending these days and the smart cities cannot be complete without smart waste management system. There needs to be system that gives prior information of the filling of the bin that alerts the municipality so that they can clean the bin on time and safeguard the environment. To avoid all such situations we intend to propose a solution for this problem "Smart Garbage Bin", which will alarm and inform the authorized person when the garbage bin is about to fill. Then message will be send to the authorized person to collect the garbage from the particular area. The authorized person will sends the message from his web application to the garbage collectors by sending a SMS .This system maintain a dry waste and a wet waste separately. This will help to reduce the overflow of the garbage bin and thus keeping the environment clean.

Keywords— Smart Garbage bins, IOT, Waste management, Raspberry pi, sensors

I. INTRODUCTION

The smart city represents nowadays hot topic in terms of improving living condition .Considering mainly the situation in European Union, the EU national governments and also private companies are investing every year significant amount of their budgets to research development and implementation of concepts of smart City. Therefore, the term smart City has many different ways how to define it. In current research this term is considered as question of _How to improve a city on different levels? The term Internet of Things was introduced by Kevin Ashton, who was the director of the Auto-ID Centre of MIT in 1999 [1]. Waste collection is an essential city service. Ample opportunity exists worldwide for smart technology to increase efficiency and improve the quality of waste collection services.

Currently, most municipal waste collection operations focus on emptying containers according to predefined schedules. This is inevitably inefficient, with half-full bins being emptied, poor use of city assets and unnecessary fleet fuel consumption. However, smart waste collection solutions on the market track waste levels and provide route optimization and operational analytics. Municipalities and waste service managers are realizing that these solutions can help them meet sustainability goals (such as zero waste), improve services for residents and reduce operational costs. Most municipal waste collection operations focus on emptying containers according to predefined schedules. This is inevitably inefficient.

The Internet of Things (IoT) is an environment in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. For instance, there are home smart devices that are synchronized with each other and can be controlled remotely. The ever-evolving IoT is making it only efficient as the user is able to control devices as per their usage and save resources. Think of your fridge with smart capabilities to know which item in your fridge is running low and it automatically refills your item via automatic shopping. This usage is more related on day to day basics however it just scratches the surface of what IoT can really do. One of the main concepts of IoT is to make it as efficient as possible for users to control devices as per their usage and save resources. When it comes to the waste industry, waste and recycling collectors are always looking at ways to minimise cost and increase productivity when possible. This would meant better utilisation of manpower, reducing fleet cost and increasing productivity per head while at the same time automate what used to be a tedious process 'fixed-route' collection method.

The IOT can change the way waste collectors carry on with their operations, know more information about their bins and bring change in the method of waste collection. Consumers on the other hand, will be able to pay reduced premium and other related costs. In short, the process of providing insurance, servicing the policies and settling the claims will be much more efficient and transparent in terms of processes.
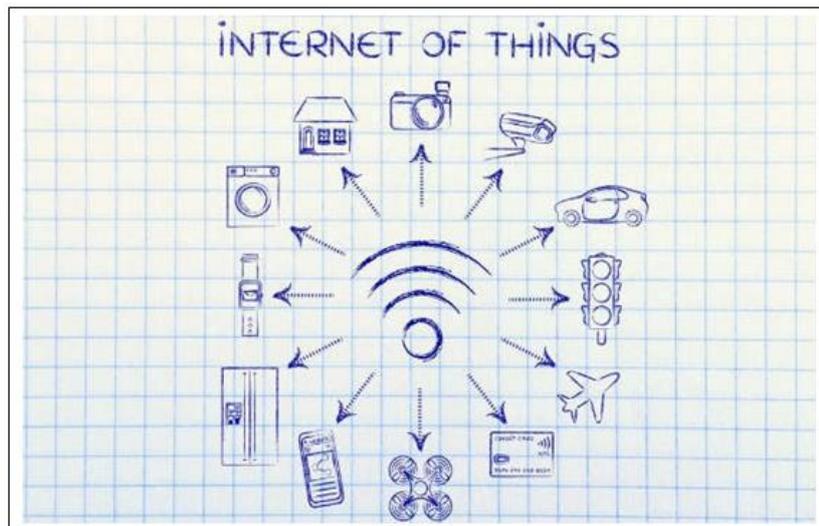
Fig. 1 Internet of Things

II. EXISTING SYSTEM

In the existing system garbage is collected by corporation by weekly once or by 2 days once. Though the garbage shrinks and overflows the garbage bin and spread over the roads and pollutes the environment. The smell will be heavy and produces air pollution and spreads disease. The street dogs and animals eat the waste food and spreads over the area and creates dirty environment.

Now a day, many times we see that the garbage bins or dust bins are placed at public places in the cities are overflowing due to increase in the waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings this leads in spreading some deadly diseases and human illness; to avoid such situation we are planning to design "IOT based waste management for smart cities". 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. When 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.

III. PURPOSE SYSTEM

We propose a smart garbage bin using cloud IOT based raspberry pi to identify when the garbage bin is fill by using Ultrasonic sensor we can get the volume occupied and left in the smart garbage bin If the volume is full then the program triggers an alert message through raspberry pi and sends an alert and location of the bin to collect the garbage's. The garbage collector collects the waste and empties the bin. Though we can manage the waste through this advanced IOT based Smart Garbage Bin. this system maintains 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 a weighted waste otherwise cap will open for dry waste. for saving a power for sensor we are using one PIR Sensor, this sensor will controls power of the sensors(ultrasonic and moister and buzzer) .If PIR detect then we will connect supply of above mention sensors through relay which will ON and if PIR not detect then remaining sensors are in off condition thereby we can reduce the power consumption of the circuit.
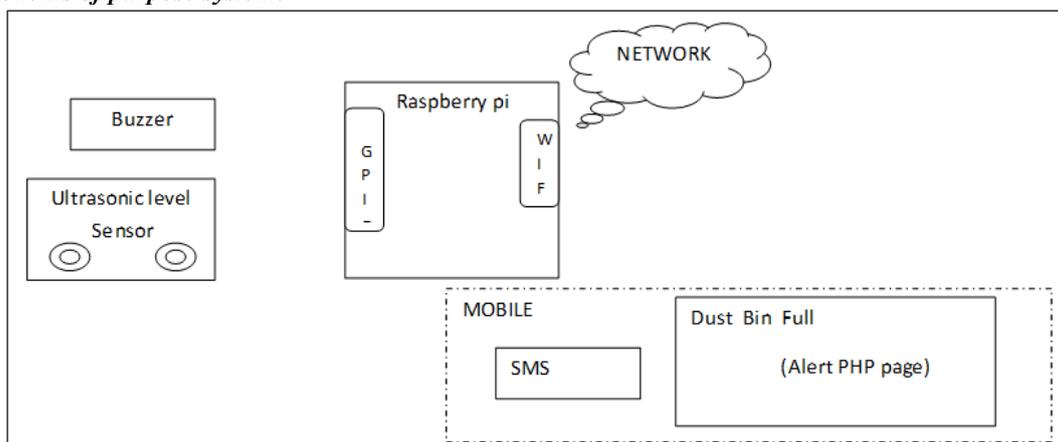
A.   Components of purpose system:

Fig. 2 Components of purpose system

Hardware Components used for implementation are:
- Raspberry Pi 3
- Ultrasonic Sensor
- Internet connection
- Buzzer, Garbage bin

Modules Description
1. **Dustbin level detection:** We propose a smart garbage bin using cloud IOT based raspberry pi to identify when the garbage bin is being fill using ultrasonic sensor we can get the volume occupied and left in the smart garbage bin. Ultrasonic distance measuring 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, ultrasonic technologies are often the only alternative to mechanical probing.
2. **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.
3. **SMS Sending:** If the volume is full then the program triggers and alert message through raspberry pi 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 SMS sending we will use a way2SMS API.
4. **Energy Save:** For saving a power for sensor we are using one PIR sensor, this sensor will control the power of the sensors (ultrasonic and moisture and buzzer). If PIR detect then we will connect supply of above mentioned sensors through relay which will ON and if PIR not detect then remaining sensors are in off condition thereby we can reduce the power consumption of the circuit.
5. **Web Application:** After filling the dustbin, we will send a message to web application.
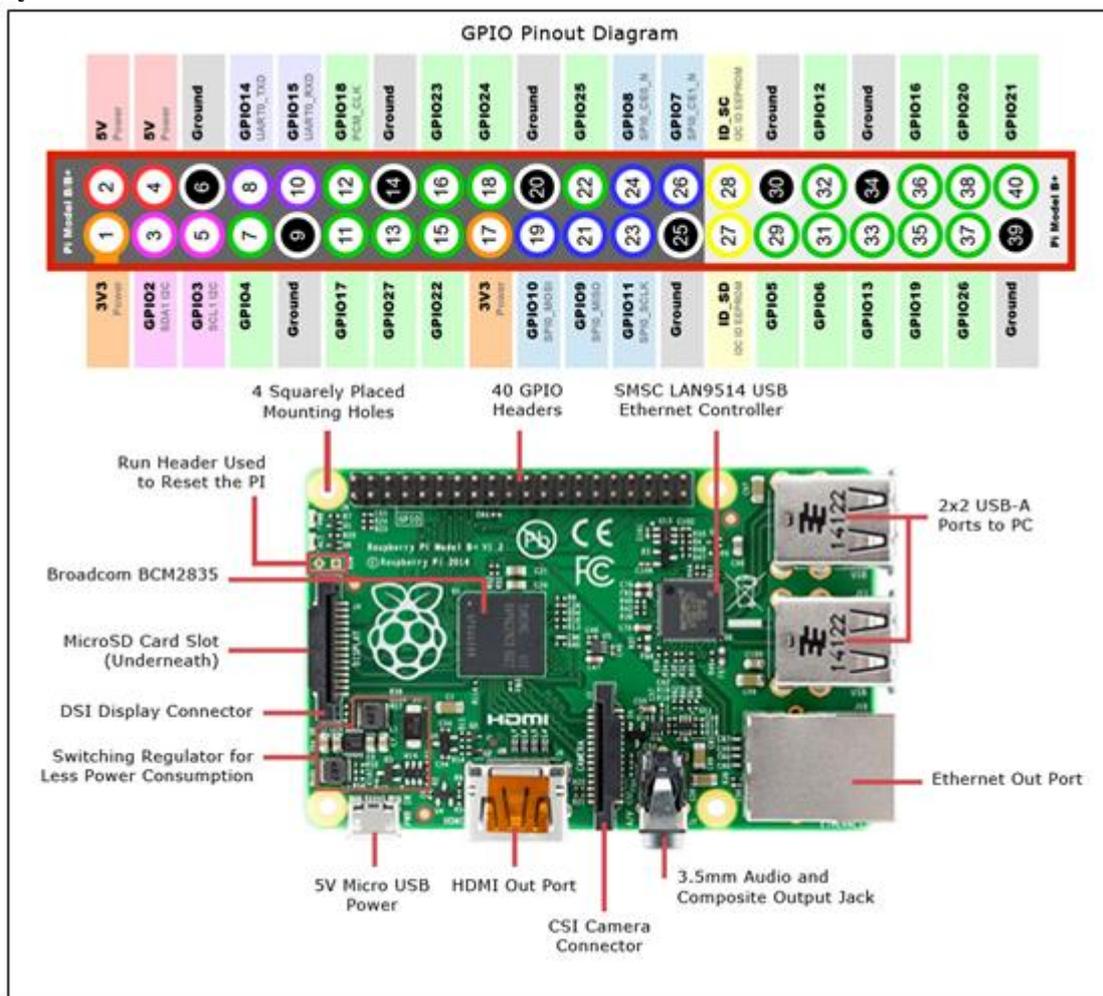
Raspberry Pi 3 architecture:

Fig. 3 Raspberry Pi 3 architecture

Steps for OS installation for Raspberry Pi:
1. Download the Raspberry Pi operating system
- Linux releases compatible with the Pi: http://www.raspberrypi.org/downloads
- The recommended OS is Raspbian: http://downloads.raspberrypi.org/raspbian_latest

2 Unzip the file that you just downloaded
- Right click on the file and choose "Extract all".
- Follow the instructions—you will end up with a file ending in .img Raspberry Pi Setup

3. Download the Win32DiskImager software
- a) Download win32diskimager-binary.zip (currently version 0.6) from: https://launchpad.net/win32-imagewriter/+download
- b) Unzip it in the same way you did the Raspbian.zip file
- c) You now have a new folder called win32diskimager-binary

4. Writing Raspbian to the SD card
- a) Plug your SD card into your PC
- b) In the folder you made in step 3(b), run the file named Win32DiskImager.exe
- c) If the SD card (Device) you are using isn't found automatically then click on the drop down box   and select it
- d) In the Image File box, choose the Raspbian .img file that you downloaded
- e) Click Write
- f) After a few minutes you will have an SD card that you can use in your Raspberry Pi

5. Booting your Raspberry Pi for the first time
- a) On first boot you will come to the Raspi-config window
- b) Change settings such as timezone and locale if you want
- c) Finally, select the second choice: expand_rootfs and say 'yes' to a reboot
- d) The Raspberry Pi will reboot and you will see raspberrypi login:
    - Username: pi, password: raspberry
- e) Start the desktop by typing: startx
- d) The desktop environment is known as the Lightweight X11 Desktop Environment (LXDE)

IV.   CONCLUSIONS

The article introduced the upcoming IoT infrastructure for smart cities and putted it in the context of municipal waste management. We provided the summary on municipal waste collection management methods and showed the examples of solutions introduced by recent research in this area. Given overview showed that it is not yet enough discussed the possibility of using genetic algorithms as a optimization method for waste collection. Our solution is based on the idea of IoT infrastructure, which should provide enough information to handle this Smart City issue more efficiently

REFERENCES
[1]   K. Ashton, "That "internet of things" thing," RFiD Journal, vol. 22, pp. 97–114, 2009.
[2]   P. Masek, K. Zeman, Z. Kuder, J. Hosek, S. Andreev, R. Fujdiak   F. Kropfl, Wireless M-BUS: An Attractive M2M Technology for 5G- Grade Home Automation, In EAI International Conference   CYber physiCaL systems, iOt and sensors Networks (CYCLONE 2015). Rome, 2015.
[3]   ReTHINK, Low power networks hold the key to IoT, Rethink Technology Research Ltd. 2015
[4]   J. Hosek, P. Masek, D. Kovac, M. Ries, F. Kropfl, Universal Smart Energy Communication Platform. In 2014 International Conference on Intelligent Green Building and Smart Grid (IGBSG). 1. Taipei, Taiwan: IEEE, 2014. p. 1-4. ISBN: 9781467361217.
[5]   M.N.K. Boulos and N.M. Al-Shorbaji, On the Internet of Things,smart cities and the WHO Healthy Cities, International Journal of Health Geographics. 2014.