

Android Enabled Waste Management System

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Abstract – With rapid urbanization, industrialization and population growth in India, waste management is becoming the key challenge for state governments and local municipal bodies. It will seriously affect the society and the quality of life of people. Waste collection is one of the important services provided by corporations that require huge investment and execution of this operation is high-priced. 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, Android enabled waste management system using GSM network is proposed to determine filled status of the garbage container and whenever the level of the garbage reaches the threshold limit it provides the communication link between coordinator and the server.

1. INTRODUCTION

Waste management means collection, transportation, processing of waste materials to ensure hygienic eco system for mankind. In this 21st century, tons of waste being generated daily due to rapid population growth and urbanization. Lack of public awareness and limited funding for garbage management programs, it is turning to be the global problem. As per the conservative estimation done by the World Bank in 1999, the municipal solid waste (MSW) from urban areas of Asia may raise from 760,000 tonnes/day in 1999 to 1.8 million tonnes/day in 2025. The traditional method in India is to empty the garbage containers placed around the city in a periodic interval. It is found that majority of the time these containers are unmasked. It is also observed that they overflow many times. This makes the city untidy and unhygienic, destroying its beauty. Further becomes the root cause for several vector borne diseases [2]. It turns to be a breeding place for mosquitoes and other insects. The wastes are to be disposed in time by the corresponding authorities. Although local authorities try to prevent the overflowing of these containers by installing larger ones, there are smarter ways to resolve this problem. Hence the objective of this research is to address the above problem. The data acquisition module placed within the container updates the server via GSM 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. The information is intimated to the garbage collection unit. The gps location of the filled garbage container is also sent via the gps. Smart containers are developed using infrared sensors for detection and GSM modules for low-power communication. Android enabled gateway provides lower bandwidth and faster transmission of updates. Optimal path for the pickup points is calculated. Using the optimal path for collection reduces the fuel and

time. The realtime implementation of the system has been discussed and the results are evaluated.

2 RELATED WORKS

2.1 Design and Implementation of IoT Based Waste Management System

The Collection of waste is a very much needed municipal service that requires huge expenditures and execution of this operation is high-priced. The high pricing is due to the various factors such as man power, navigation of vehicles, fuel, maintenances and environmental costs.

2.2 SMART WASTE MANAGEMENT SYSTEM

The waste collection process is a critical aspect for the service providers. The traditional way of manually monitoring the wastes in waste bins is a complex, cumbersome process and utilizes more human effort, time and cost which is not compatible with the present day technologies. Irregular management of waste typically domestic waste, industrial waste and environmental waste is a root cause for many of the human problems such as pollution, diseases and has adverse effects on the hygiene of living being

2.3 Smart garbage monitoring and clearance system using internet of things

The increase in population, has led to tremendous degradation in the state of affairs of hygiene with respect to waste management system. The spillover of waste in civic areas generates the polluted condition in the neighboring areas. It may aggravate numerous severe diseases for the nearby people.

2.4 SVASTHA: An effective solid waste management system for Thiruvalla Municipality in Android OS

The rapid urbanization in Kerala has led to increased generation of municipal solid waste (MSW), which will seriously affect the society and the quality of life of people. Although some action has taken from the part of

government against this, the poor management of waste has led to pollution and to the emission of greenhouse gases

2.5 Solid Waste Collection and Monitoring System

Pune Municipal Corporation aims to Enhance operational capability, citizen's satisfaction, reliability and on time-availability of its services offered through various departments like Solid Waste Engineering services and scheduling services etc. As waste management operations all over the world attempt to become cleaner and greener, Pune Municipal Corporation is leading the way with complete end-to-end automation and monitoring of waste collection and management. In the traditional approach, a number of trucks from the municipal authority are sent to the waste bins to collect the Municipal waste (MW). The wastes are loaded in the truck and then transported and transferred to the pre-specified locality. However the group of the people involved in collecting and transporting the wastes are usually not responsible enough to make the job well Corresponding Author: J. Ms. Kokila, PG Scholar, Dr. N G P Institute of Technology, Coimbatore, India. 995Middle-East J. Sci. Res., 25 (5): 995-1000, 2017 done. Very often the wastes are not collected from each and every waste bin properly due to driver's attitude and lethargy [1]. An embedded system using sensors, ARM 7 controller and ZigBee technology for management of garbage or solid waste was implemented [2]. The sensors are placed in the garbage bins at the public places. When the pre-defined level of the garbage in the smart bin is reached, indication will be given by the controller to the driver of waste collection truck. This system creates immediate attention but did not focus on segregation of waste. The above stated disadvantages were overcome by proposing an e-monitoring system that consists of RFID technology interfaced with PIC micro-controller and a web based computerized software [3]. This centralized GUI tool can be accessed from anywhere for the information to be viewed by different category of people. This facility also helps the public to lodge their complaints and comments. It has been explored in the laboratory environment as well as in the field environment. The test results show that the system functions properly and is working real time. Municipality can monitor the MW collecting status through the system and can produce different reports to improve the performance of their service. To reduce the cost, integrated sensing system were designed using rule based decision procedure that is efficient and intelligent can be used to automate any solid waste bin management and monitoring system [4]. Pavithra et al. [5] developed a

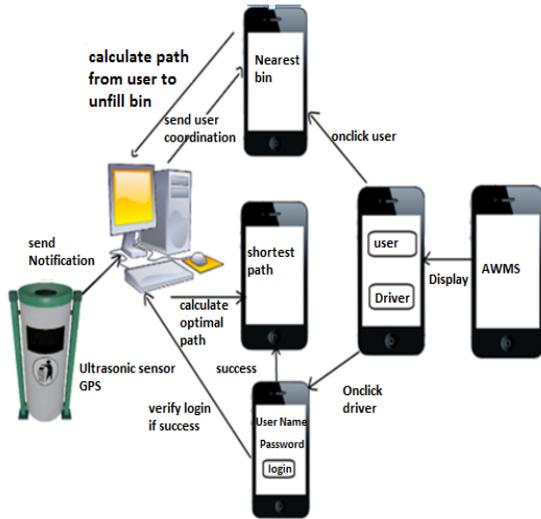
system to intimate the clearance of waste to the corporation office by positioning the sensor and microcontroller in the trash bin. An alarm indication is also incorporated to confirm the clearance of waste. This set up helps the municipality for the immediate disposal of bin thus reducing the spread of disease. The researcher introduced additional sensors, IR sensors, Humidity sensors and Toxic gas sensors to measure the status of bin [6]. The processor transmit the bin filling alert, Humidity alert and Toxic gas alert to the Municipal Corporation via SMS intimation with the help of GSM technology in order to reduce waste dumping. Further modifications were also performed in the category of processing and recycling of the waste. The separations of five types of plastic resins using NIR spectroscopy to produce biogas from the rest of biodegradable waste were introduced. The NIR reflectance spectroscopy scheme helps to distinguish and eliminate plastic item from MSW and provides all biodegradable substance that can be further used in biogas plant [7]. Implementation of the above smart bin can prevent lumping of the trash for a longer period of time thereby preventing the widespread of diseases to a great extent and promising a clean environment in the city [8].

There is a decrease in the environmental and operational cost as a result of optimization of the resources and an effective usage of smart dustbins. It has indirectly reduced the traffic in city. In major cities the waste gathering vehicle visit the area's everyday twice or thrice depends on the population of the particular area and sometimes these dustbins may not be full. Informing the status of each and every dust bin in real time to the concerned authority can send the garbage collection vehicle only when the dustbin is full [9]. This work has focused on the implementation of smart waste management system using sensors, Arduino and GSM technology integrated with IoT.

The status of the bin is continuously monitored at the control station to provide a user interaction with the system. The values stored in the database helps a user to have the updated status of the data in the bin as well as the previous values of the parameters of the bin. This collected data from the bin can be used in the optimization of routes for the collection trucks for efficient use of resources in the waste management system [10].

PROPOSED SYSTEM

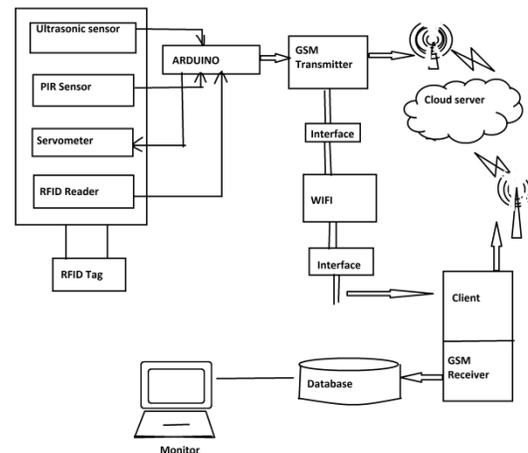
BLOCK DIAGRAM



The bin with ultrasonic sensor, PIC controller, GSM and GPS will notify the coordinate and bin status to the database. Here GSM is user to communicate with the server, which will contain the SIM with the basic speed internet. The ultrasonic sensor which uses ultrasonic waves will check the bin status. The PIC controller board is used to control ultrasonic sensor, GSM and GPS. The server will maintain the details of the unfilled bins, filled bins and authority registration. Whenever the normal user or authorised bin collect or request from the database the information will be given to them. The information to the normal user is about the nearest unfilled bin and authorised person will be given the coordinates of the filled bins. The user end will contain the android app which works on android compatible phone. There will be two separate buttons for user and authority. The user will notify the unfilled nearest bin with path and authorised person will be notified by the filled bins with path. The working is as follows, User inserts trash into the bin, Bin checks for threshold level, Bin sends the status and coordinates to the Control centre on reaching the appropriate level, Control centre uses the coordinates sent by multiple Bins and provides an optimal path to the garbage vehicle, The bin if emptied by the vehicle, a notification is sent by it to Control centre. This helps in easy monitoring. The proposed architecture of IoT based waste management system shown in Fig. 1 is categorized into three modules. Smart Control and lid Sensing System – Ultrasonic Sensor, PIR Sensor, Servo motor, RFID Reader Transceiver Unit – GSM, Wi-Fi, ThingSpeak Smart Display Unit - LCD, Database, Monitor Section

The Fig. 2 shows the process flow of the implemented system. A PIR sensor is a motion detector sensor which detects the heat emitted naturally by human. Whenever a person is in the field of vision nearer to the garbage bin, the sensor is triggered and the servo motor automatically opens the smart bin for the disposal of waste. Lid Sensing system detects the overflow status of the garbage level in the dustbin using ultrasonic sensor. This Smart Trash Bin is interfaced with Arduino and whenever the lid sensing system is activated, a signal is transmitted through the GSM module to the server in the municipal office. After the disposal of waste, the above process is confirmed by the yardman using RFID Tag. RFID reader reads the tag and sends the status of cleaning to the server confirming the work done. The LCD screen is used to demonstration the status garbage collected in the bins. Wi-Fi module helps us to send the details of the smart bin at the receiver

Experimental Analysis



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The garbage level in the bin is less than 15cm - Garbage Empty
The garbage level in the bin is greater than 15cm - Garbage Full

PIR Sensor and Servo Motor: HC-SR501 is a motion detector sensor which detects the heat emitted naturally by human. Whenever a person is in the field of vision nearer to the garbage bin, the sensor is triggered. SG- 90MINI, a position controlled servo motor is programmed for the automatic opening of the waste bin for the disposal of waste. It can easily control physical movement of objects due to its position controlled feature. Servo motor rotates in angle ranging from 0 to 180 degree and has many applications in robotics and industry for position based motion control system. Unlike other motors, servo motor is very easy to interface with Arduino or any other microcontroller due to its built-in controllers. The conditions programmed in Arduino board for the rotation of servo motor based on the output of PIR sensor is listed below. When the Output level of PIR sensor is equal to high - Motion detected, the servo motor rotates clockwise in an angle from 0° to 180° and automatically opens the waste bin. For closing the bin there will be an anti-clockwise rotation from 180° to 0°.

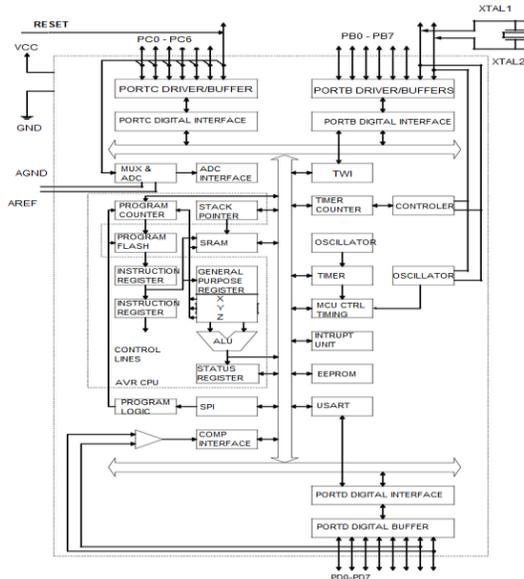
When the Output level of PIR is equal to low - Motion not detected, the servo motor rotates anti-clockwise in an angle from 180° to 0°.

RFID Detection: EM-18 RFID reader is a device that will read data on tags and communicate to a computer system without any physical association. The RFID tag comprises of three parts: an antenna, a semiconductor chip attached to the antenna with encapsulation. The tag reader is liable for powering

and sharing with a tag. The tag antenna captures energy and transfers the tag's ID. nsor is equal to low - Motion not detected. Transceiver Unit WIFI Module: The ESP8266 is a self-contained Single on Chip Wi-Fi Module with incorporated TCP/IP protocol stack that can provide microcontroller access to your Wi-Fi network. This component is comprised of 32 bit microcontroller associated with devices like ADC, UART, PLL and memories. It encompasses a self-calibrated RF permitting it to work under all working conditions and requires no external RF parts. The applications of ESP8266 are Smart power plugs, Home automation, Wi-Fi location- aware devices, Industrial wireless control and Security ID tags. Wi-Fi helps us to send details of smart Mart Display Unit Monitoring System: ThingSpeak is IoT platform in which the user must create the channels by giving all the credential required, once the channel is created nearly 8 sensor values can be feed to the thingspeak channel and the data in channel can be accessed by anywhere in the world. The Smart control and Lid sensing system connected to Arduino and GSM will feed the sensed data to IoT -ThingSpeak application over the Internet. In the proposed system, ultrasonic sensor data are feed to the thingspeak channel. The Fig. 3 (a) and Fig. 3 (b) shows the result of garbage monitoring system measured in real time environment. The sensed data from the ultrasonic sensor will be stored in the channel. The collected data of the different garbage level measured from 12.59 pm till 17.00 pm are represented in the form of a graph for monitoring purpose. In addition to the above, the location can also be viewed as shown in the Fig. 3(c) at Dr. G P Institute of Technology, Coimbatore, India. This test run were implemented at different places in diverse times with different level of garbage bin at the receiver side. Graph Theory Optimization Algorithm: Optimization algorithms are applied to find the shortest distance between two points in the area for the yardman to follow for cleaning the smart bin. The routes are optimized to minimize driving time based on historical data or traffic blocking. This data processed by graph theory optimization algorithms can be used to dynamically and efficiently manage waste collection strategies. The following steps are used in a graph theory algorithm, Location of data collection Graph modelling for plotting data Graph Bi-Partitioning for possible routes Applying algorithm on datasets Suitable path will be chosen for cleaning the smartbin.

MICROCONTROLLER – ATMEGA 8

BLOCK DIAGRAM



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