

SMART WASTE MANAGEMENT USING IOT AND WI-FI TECHNOLOGY

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Abstract

Waste Management is the discipline associated with the control of generation, collection, storage, transfer and transport processing. Municipal governments are largely responsible for building and maintaining of waste disposal networks. Nowadays the Dustbins placed in public are overflowing due to increase in waste in cities. Environmental and health issues arise from the unsustainable management of the wastes. The result indicates that the waste dump sites on the major streets and several open spaces are left unattended for long periods such that the rubbish heaps, encroach on the roads thereby limiting the road user's access, generate serious air pollution issues, constitute significant nuisance, when waste materials are blown over by winds, and distorts the aesthetic view of the metropolis. Due to the lack of resource, the municipal corporation does not get information about overflow dustbins. This leads to unhygienic condition in cities and cause health hazards. The IoT provides solution for the waste management problem. The Internet of Things is the network of physical devices embedded with software, sensors and network connectivity which enable these objects to collect and exchange data. The main purpose of this system is to develop and control the disposing waste by the information collected from sensors.

Keywords: IoT, Wi-Fi, Arduino, LCD, Micro controller

1. INTRODUCTION

1.1 Waste Management

In India about 60 million tons of wastes are generated every year. Ten million tons of garbage are generated in metropolitan cities. The landfills of most of these cities are overflowing with no space for fresh garbage waste. The philosophy of "waste management hierarchy" has been adopted by most nations as the step for developing Municipal Solid Waste (MSW) management strategies. According to

sanitation survey called “Swachh Survekshan-2016” conducted by the ministry of urban development under the swachh bharat mission, it was found that about 50% people in India face the problem of improper waste collection and management. According to centre of science and environment, innovative disposal and recycling methods must be introduced instead of landfill sites. Automatic waste monitoring system for proper management of waste is cost effective. Automatic waste segregator categorizes the waste as plastic, metallic or organic. The monitoring system helps to monitor the waste collection process. The common method of waste disposal is by unplanned and uncontrolled dumping at landfill areas. This method is hazardous to human health, plant and animal life. When the waste is segregated into basic streams such as plastic, metallic and organic, the waste has a higher potential of recovery, and then, recycled and reused. The organic waste is converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metal waste could be reused or recycled. Even if there are large scale industrial waste segregators present, it is always feasible to separate the waste at the source itself. IoT based waste management system reduces the occupational hazard for waste workers. The separated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant then to the recycling plant. It is an advanced domain of technology in which all data is stored in the cloud with real time quick access to data.

1.2 IoT

The Internet of Things is the concept of connecting any device to the Internet and to other connected devices. The IoT is a giant network of connected things and people – all of which collect and share data about the way they are used and about the environment around them. “any device capable, can be interconnected with other devices”. “Smart cities” can use it to reduce waste and maximize the efficient use of energy. In truth, the IoT provides a nearly endless supply of opportunities to interconnect our devices and equipment. In terms of creativity, this field is wide open, with an infinite number of ways to “interconnect the devices.” It can be an exciting time for innovative individuals, in part, because of the impact of these interconnections. The IoT offers solution to various real time smart devices problems. That’s why IoT technology is used in waste manage system.

2. RELATED WORK

2.1 Solid urban waste management

The IoT incorporates transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a

system. It focus specifically to an urban IoT system that, while still being quite a broad category, characterized by their specific application domain. Urban IoT's, in fact, are designed to support the Smart City vision, which aims at exploiting the most advanced communication technologies to support added-value services for the administration of the city and for the citizens. This provides a comprehensive survey of the enabling technologies, protocols, and architecture for an urban IoT.

2.2 Intelligent waste monitoring using base station

In most of the places, the garbage bins are not cleaned at proper time intervals which results in overflowing of garbage resulting in hygiene problems, land pollution; also it creates ugliness to that place. This shows the need for a system that monitors the status of the garbage bin and provides information to the concerned authorities to manage the collection intervals for cleaning the bins. A solution to this problem is proposed in this paper in the form of a 3 tier waste management system: Intelligent bin, gateway, remote base station. The parameters of the bin monitored are transmitted through a gateway to remote base station to be stored in a database.

2.3 Smart Garbage Detection System

Owing to a paradigm shift toward Internet of Things (IoT), researches into IoT services have been conducted in a wide range of fields. As a major application field of IoT, waste management has become a big issue. The absence of efficient waste management has caused serious environmental problems and cost issues. The probable solution to this problem is for urban cities. Using IoT technologies for waste management, one probable solution can be made through the work. It explains the 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.

3. DETECTION AND CONTROL OF DISPOSING WASTE

3.1 Proposed System

Many times, in our city the garbage bins or dustbins are placed at public places get overloaded often. It creates unhygienic conditions for people as well as ugliness to that place leaving bad smell. To avoid all such situations the implementation of a project is done which is called IoT Based Waste Collection bins. These dustbins are interfaced with Arduino microcontroller based system having IR wireless systems along with central system showing current status of garbage, on mobile web browser with html page by Wi-Fi. Hence the status will be updated on to the html page.

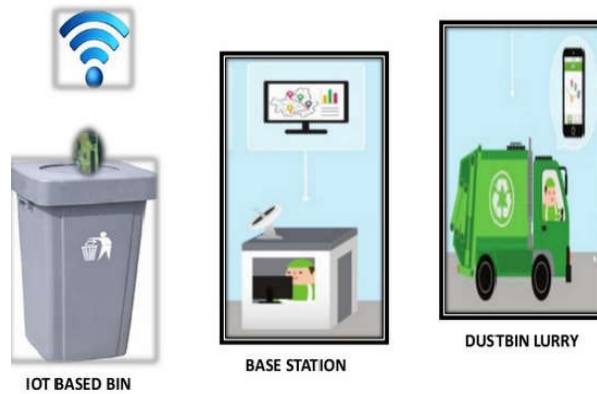


Fig.3.1 Proposed Model

Major part of the project depends upon the working of the Wi-Fi module; essential for its implementation. The main aim of this project is to reduce human resources and efforts along with the enhancement of a smart city vision. From Fig.3.1, dustbins are interfaced with microcontroller based system having IR wireless systems along with central system showing current status of garbage, on mobile web browser with html page by Wi-Fi. Hence the status will be updated on to the HTML page. Major part of the proposed project depends upon the working of the Wi-Fi module; essential for its implementation. The main aim of the proposed project is to reduce human resources and efforts along with the enhancement of a smart city vision. The motto of the proposed project is to develop the system which uses the information collected from sensors to manage the collected garbage and buzzer for alerting the responsible persons.

3.1.1 Advantages of Proposed System

- The proposed system collects dry and wet waste separately which is placed in a conveyor belt and the dry waste collected dust bins are placed left side and wet waste collected bins on right side.
- Each Smart bin has Unique ID which is its location co-ordinate.
- Each Smart Bin can sense the level of garbage in it and send this level of overloading to the central website.
- Bad odor or Smell can be detected and notified in website.
- The proposed project reduces the man power.
- Environment cleanliness is maintained in proper way and hygienic conditions can be provided for the people.

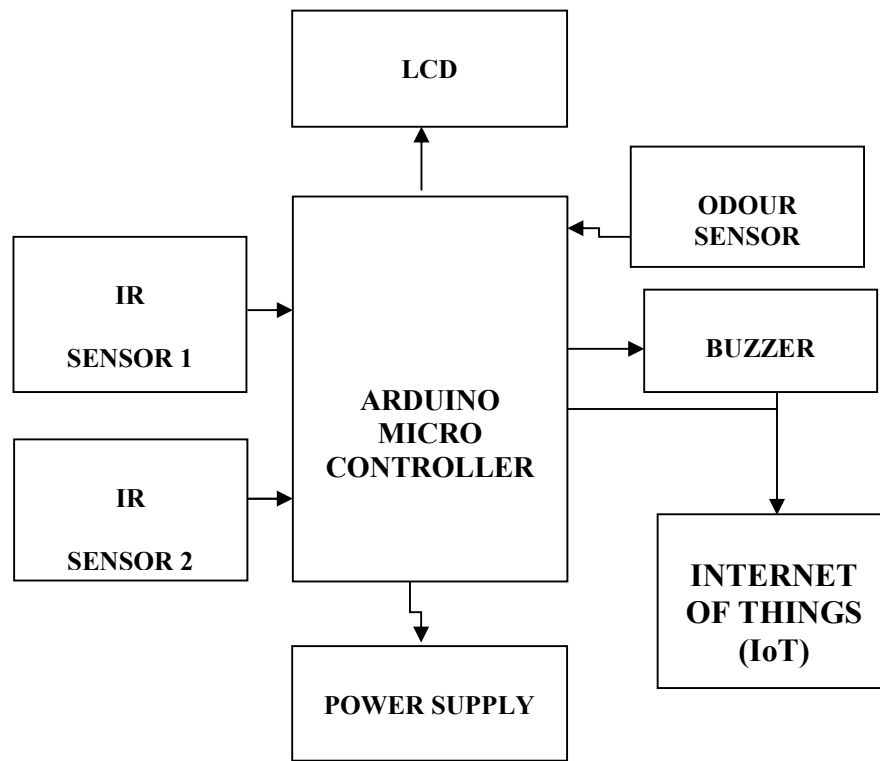
The primary objective of the proposed project is to secure the best environmental management of all waste including preventing and minimizing the generation of waste wherever practicable. In order of

priority, waste must be prevented, minimized, used, recycled, recovered and disposed of safely, having regard to public health and environmental protection, occupational hazards in waste handling as well as having regard to the best value solution. There were three criteria, each of which receives equal weighting, used in the devising of the specific policy of this plan. These criteria were environmental and health impacts, ability to meet the necessary targets and financial assessment.

3.2 Module Description

Literally billions of devices are being interconnected together, making it possible (eventually) for someone to hack into your coffee maker, and then access your entire network. The Internet of Things makes businesses all around the world more open to security threats. Additionally, data sharing and privacy becomes issues when using the Internet of Things. Since billions of devices are interconnected using IoT, there are more security issues in IoT. Some businesses will be faced with storing the massive amounts of information these devices will be producing. They will need to find a method of securely storing the data, while still being able to access, track, and analyze the huge amounts of it being generated. Wearable IoT technology is a very large domain and consists of an array of devices. These devices broadly cover the fitness, health and entertainment requirements.

3.3 Block Diagram



4. EXPERIMENTAL RESULTS



Fig. 4.1. Smart Waste Management System

| Row# | Value | Receivedate |
|------|---|-----------------------|
| 90 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/22/2018 1:38:40 PM |
| 95 | CHE.SN:MYLERIPALAYAM,NONDISPOSABLEWASTEFULL | 3/22/2018 1:55:49 PM |
| 94 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/22/2018 1:53:38 PM |
| 93 | IoT APPLICATIONS_DATA_MONITOR | 3/22/2018 1:51:25 PM |
| 92 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/22/2018 10:16:39 AM |
| 91 | IoT APPLICATIONS_DATA_MONITOR | 3/22/2018 10:16:23 AM |
| 90 | IoT APPLICATIONS_DATA_MONITOR | 3/22/2018 10:02:40 AM |
| 89 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 12:10:40 PM |
| 88 | CHE.SN:MYLERIPALAYAM,NONDISPOSABLEWASTEFULL | 3/21/2018 12:09:40 PM |
| 87 | CHE.SN:MYLERIPALAYAM,DISPOSABLEWASTEFULL | 3/21/2018 12:09:04 PM |
| 86 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 12:08:27 PM |
| 85 | IoT APPLICATIONS_DATA_MONITOR | 3/21/2018 12:08:17 PM |
| 84 | IoT APPLICATIONS_DATA_MONITOR | 3/21/2018 11:59:10 AM |
| 83 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:56:20 AM |
| 82 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:56:05 AM |
| 81 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:55:47 AM |
| 80 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:55:31 AM |
| 79 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:55:15 AM |
| 78 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:54:57 AM |
| 77 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:54:41 AM |
| 76 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:54:17 AM |
| 75 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:53:49 AM |
| 74 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:53:31 AM |
| 73 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/21/2018 11:52:41 AM |
| 72 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:49:28 PM |
| 71 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:49:03 PM |
| 70 | IoT APPLICATIONS_DATA_MONITOR | 3/19/2018 4:48:51 PM |
| 69 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:48:21 PM |
| 68 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:48:12 PM |
| 67 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:48:04 PM |
| 66 | IoT APPLICATIONS_DATA_MONITOR | 3/19/2018 4:47:51 PM |
| 65 | IoT APPLICATIONS_DATA_MONITOR | 3/19/2018 4:41:33 PM |
| 64 | IoT APPLICATIONS_DATA_MONITOR | 3/19/2018 4:39:10 PM |
| 63 | IoT APPLICATIONS_DATA_MONITOR | 3/19/2018 4:36:38 PM |
| 62 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:36:20 PM |
| 61 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:36:11 PM |
| 60 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:36:02 PM |
| 59 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:54 PM |
| 58 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:45 PM |
| 57 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:37 PM |
| 56 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:28 PM |
| 55 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:20 PM |
| 54 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:11 PM |
| 53 | CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:35:02 PM |
| 52 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:54 PM |
| 51 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:45 PM |
| 50 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:37 PM |
| 49 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:28 PM |
| 48 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:20 PM |
| 47 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:11 PM |
| 46 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:34:02 PM |
| 45 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:33:54 PM |
| 44 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:33:45 PM |
| 43 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:33:37 PM |
| 42 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:33:28 PM |
| 41 | CHE.ST_NAME*CHE.ST_NAME:MYLERIPALAYAM,ODOR DETECTED | 3/19/2018 4:33:20 PM |

Fig. 4.2. Alert message to web interface

5. CONCLUSION

Environmental cleanliness is the most important factor to be considered in the developing countries. This project helps to automate the waste management system. Using IoT, the status of the trash in each local area can be updated to the Municipality. If the dustbin is not cleaned in specific time, then the record is sent to the higher authority who can take appropriate action against the concerned official. This system also helps to monitor the fake reports and it 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. IR and Smell sensors and its other hardware micro controllers and processors such as Arduino is used for analyzing the garbage overflow by sending information to administrators so that the garbage trucks are being deployed by them. Another very important aspect of the project is the web portal that is designed in such a way that operators and citizens both will find it user friendly to monitor the garbage information of various places.

Finally, the future work is focused on the definition of an effective IoT enabled model for waste collection, which will touch on the incorporation of high capacity waste trucks as mobile depots. In addition, waste bins are placed to optimize comfort of residents. The part of the future work will be looking at bin connectivity constraints that may affect their placement, the output power of a communicating sensor would need to be set too high which may drain the battery faster. The bin may be placed where energy consumption is more efficient.

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