

AUTOMATION OF SMART WASTE MANAGEMENT USING IoT TO SUPPORT “SWACHH BHARAT ABHIYAN” – A PRACTICAL APPROACH

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Abstract:

“Swachh Bharat Abhiyaan” is a national campaign by the Government of India, covering 4,041 statutory cities and towns, to clean the streets, roads and infrastructure of the country. The aim of the mission is to cover all the rural and urban areas of the country to present this country as an ideal country before the world. With the proliferation of Internet of Things (IoT) devices such as Smartphone & sensors, this paper describes the effective dry and wet dirt collection using Embedded System. The main motto of the application is collection of dry and wet waste separately which is placed in a conveyor belt on which the dry waste collected dust bins are placed left side and wet waste collected bins on right side. The system will get the input through the dust collecting person through switches and sends signal to the Micro controller unit using RF technology and that makes the H-bridge to rotate conveyor belt. When the belt starts rotating clockwise the dust bin’s lid is automatically closed, simultaneously the waste is dumped into the underground garbage container placed at the ground floor. Here IoT module is used to control and monitor the waste and the information will be sent to the particular organization and the common man. The mobile app shows the collection of waste and the particular date and arrival time of the vehicle.

Keywords: Microcontroller, H-Bridge, IoT, Android Application

1 Introduction

Internet plays an important role in today’s world by connecting computers to World Wide Web (www) which creates opportunity to communicate with larger areas. IoT (Internet of Things) divided into Industrial IoT and commercial IOT in which technology and applications were discussed with various statics in detail. Using IoT controlling and monitoring of equipments were clearly explained in which sensors will play an important role. With help of sensors like Ultrasonic Sensors, weight and garbage levels are indentified and display message/ intimate to the corresponding organization. Detail explanations of the

hardware were discussed in the Design and Implementation part which is mentioned in section 3 and 4.

2 Related Work

2.1 Waste management in USA

UG (Under Ground) LIFT waste compactor is a space volume saving and modern system for all locations in which environment poses the challenges to the implementer. There is only a tiny or small bin in the ground. The assembly underground consists of two unit’s i.e. Container with a metal frame & compactor. Installation of this system in a ready pit which takes only about

three to four hours. The system is suited to all types of waste (Dry & Wet) and is an efficient solution for recycling. This system can be dimensioned or graphed to match the location with standard compactor sizes are (10m³, 16m³ and 20m³). In largest or limited size for UG LIFT underground compactor holds (>100m³) of uncompact waste. A large and cool container enables longer emptying intervals (no external odors). Financial and ecological savings are made in waste transportation costs. The UG LIFT system, intermediate waste storage can be realized in a modern and safe manner even in many demanding locations. An underground intermediate storage solution is cool all the year round, and both the collection container & environment can be more hygienic and odor-free. UG LIFT waste compactor system is suitable for any location where the cost-efficient and ecological waste management system is provided.

2.2 Waste management system in Australia

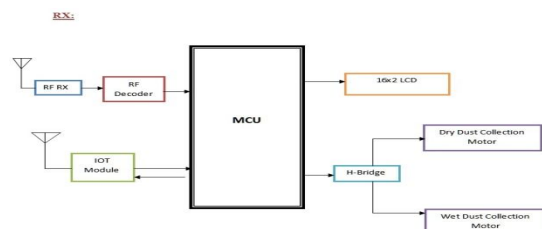
An automated vacuum waste collection system, also known as pneumatic refuse collection or automated vacuum collection (AVAC), transports waste at maximum speed through underground pneumatic tubes to the collection station where it is compacted and sealed in containers. When the container is full, it is transported away and emptied (by using trucks). The system helps facilitates separation and recycling of waste. The process begins with the deposit of trash into intake hatches, called portholes, which may be specialized for waste, recycling. Portholes are located in areas (public) and on private property where the owner has opted in. The waste is then pulled through an underground pipeline by an air pressure difference i.e., created by large industrial fans, in response to porthole sensors that indicate when the trash needs to be emptied and help ensure that only 1 kind of waste material is travelling through the pipe at a that time. The pipelines converge on a central processing facility that uses automated software to direct the waste to the proper container, from there to be trucked into the trucks to its final location, such as a landfill or composting plant. The Envac proprietary system, Envac Automated Waste

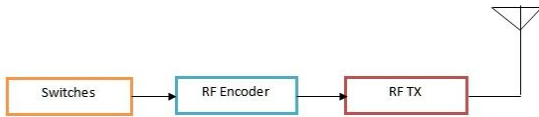
Collection System, is used in more than 30 countries. Major cities in which the system is operating include Copenhagen, Barcelona, London, and Stockholm.

3 Design:

Our project can be implemented for apartment type buildings that may also include industries wherein, the demanded resource for the implementer or the designer is provided. Installation of the process includes tech bins, 2 conveyor belts (one for dry waste & the other for wet waste), IoT module to instruct & Underground bin facility. These tech bins (one for dry & another for wet waste) are kept on the either corner side of the apartment (in each floor) where the owner opts, but it should be a centralized view to ease the construction process. If the opted place of owner has all the resources given to the implementer then, the installation of project will be executed. The bins are infixed with level sensor (ultrasonic sensor) to indicate the weight and level of garbage in the bin. These bins have lids which will close automatically if it is 80% garbage in all bins in which automatic rotation of the conveyor belt is performed. If in partial cases, then the manual operation is done by switching the switches (one for backward & the other for forward) in each floor. When the operated bin reaches the ground floor, then the waste is dumped in the underground bin. When the conveyor belt rotates for one cycle the information or the database of the dustbin is made enabled to people to look in into the application called “Things view” (an android application) & for the municipal corporation of the city, via the mobile communication network, the signals are sent to a web-based software application which is viewed by waste management company.

3.1 Block Diagram:





RF technology: Here we have radio frequency transmitter & receiver, to communicate between the micro-controller and switches. LCD is used to display the status of tech bin, IoT module to instruct, h-bridge to connect 2 D.C motors which will help to the run the conveyer belt. The input to the circuit is applied from the regulated power supply. The A.C input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating D.C voltage. So in order to get a pure D.C voltage, the output voltage from the rectifier is fed to a filter to remove any A.C components present even after rectification.

4. Working Principle & Model

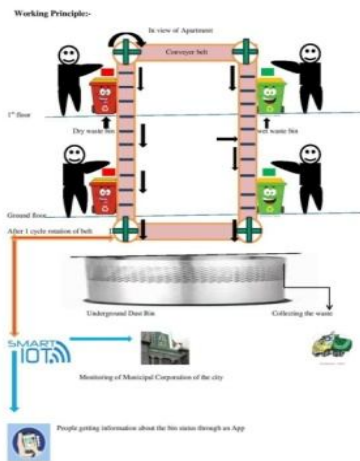


Fig 7 represents the working principle of the model

Fig. 1 represent Working Principle

These tech bins (one for dry & another for wet waste) are kept on the either corner side of the apartment (in each floor) where the owner opts, but it should be a centralized view to ease the construction process. If the opted place of owner

has all the resources given to the implementer then, the installation of project will be executed. The bins are infixed with level sensor (ultrasonic sensor) to indicate the level of garbage in the bin, **IoT** module to instruct the status of the bin. These bins has closing lids which closes as there is a 80% garbage in the particular bin, if there is a case that all the bins attached to the conveyer belt on either side contains 80% garbage then automatic rotation of the conveyer belt is done by using RF technology. If in partial cases, then the manual operation is done by switching the switches (one for backward & the other for forward) in each floor. When the operated bin reaches the ground floor, then the waste is dumped in the underground bin.

4.1 Role of IoT

When the conveyor belt rotates with the proliferation of D.C motor, hence after one cycle of rotation of conveyor belt the information or the database of the dustbin is made enabled to people to look in into the application called "Things view" & the monitored information of the garbage to the municipal corporation of the city. The above process is done via the mobile communication network, the signals are sent to a web-based software application which is viewed by waste management company (Municipal Corporation of the city).

4.2 Model



Fig. 2 represents Microcontroller kit

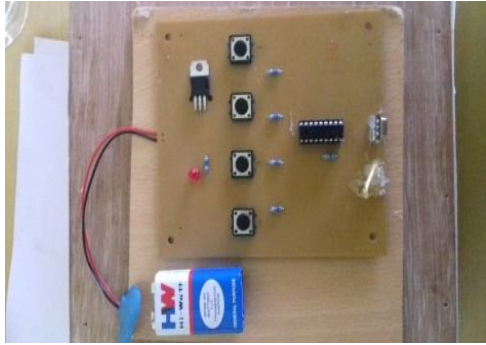


Fig. 3 represents Microcontroller Kit



Fig. 4 represents Apartment Model

5 Results

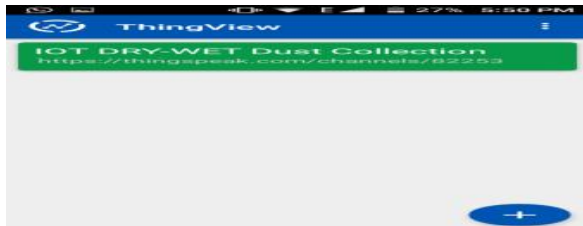


Fig. 5 represents Thingview Android App

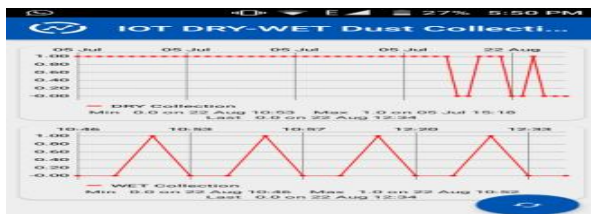


Fig. 6 represents Analysis of Garbage Collection

The above diagram shows the representation of graph which is used in “Things View” (an android application) running in phone which

indicates the time & date (when the garbage is emptied), which type of waste is been collected in the particular apartment

6 Cost Analysis

Implementation process of the project can cost around Rs 2.5 lakh @ min & as a part of implementation process i.e., cost of tech bin & conveyor belt depends upon how much can the owner afford financially, that includes based on size, quantity & quality (q & q). This project can be implemented in the future apartments & as well the existing apartments, but in existing apartments the important case is providing resources & the process can be implemented to any number of floors (present maximum is up to 16 floors).

Conclusion

The targeted waste collection saves times, money, and fuel and also reduce exhaust gas emission. Even garbage truck tours can be reduced by 30%. Hence by this project we can deal with RF technology, collection of garbage to make the premises clean.

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