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IoT Enabled Rural Waste Management System

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Abstract

Developing countries like India are based on the principles of "sustainable development", "precaution" and "polluter pays" but the growth of e-wastes and bio-wastes troubles the sustainability in multiple ways. Though the degradable wastes are easily be broken down but the process of decomposition chemically or biologically has stage of rotting, wastes certain stage will cause many spreadable diseases which is vulnerable to teens and infants. So, the usual procedure is to discarding the bio wastes using garbage covers and garbage trucks to transport it. Human errors can be tolerated but in some cases that wasn't a fact, during the transport service some garbage cans will left unpicked to over this we came up with IoT enabled System to Manage this process accurately. Which will have the data of the garbage Containment and the real time location and the time for fast and clear transportation and also the system will work the logic for the route propagation of the tuck.

Keywords - E-waste, Bio-waste, Rotting, IoT, Real time Location

I. INTRODUCTION

This paper proposes a technique to Manage the process of waste management in countries like India there is no advanced technologies every where, when its comes for Rural areas the common dustbins will contain wastes at rotting condition which is the usual means of spreading of disease and also it will contain infectious agents and it is geno-toxic. Hospital garbage will contain toxic and hazardous chemicals and pharmaceuticals. Lack of safety kits for workers dealing with bio-medical waste. Considering this fact the wastes has to be discarded from the living areas as soon as possibles, so tracking the trucks routes and the Garbage containers could eradicate most of the Problems and also the typical Human errors.

II. PROBLEM STATEMENT

A. Viral and Bacterial Diseases wide spread

In our generation we are witnessing different kinds of either bacterial or viral diseases by means of medium but most common medium used for the generation and spread is Disposals. In this certain case Disposing stuffs which is not use is inevitable, but through this diseases like Amoebiasis, bacillary dysentry. Cholera, giardia, and Cryptosporidiosis will spread. These are illness caused by micro-organism in untreated or contaminated wastes and still Waters. So, Discarding the waste from human living area as soon as possible is an essential part.

B. *Pharmaceuticals Toxic Wastes*.

In Rest Press release of World Health Organization

which is the one of the Organs of the United Nations, they stated that the faces of an infected person appears to be low for spreading virus like COVID-19 but there is some evidence that the COVID-19 virus may lead to intestinal infection and to be present in the faeces, approximately 2 to 10% of cases of confirmed COVID-19 disease presented with diarrhoea (2−4), and two studies detected COVID-19 viral RNA fragments in the fecal matter of COVID-19 patients (5,6). Not only the fecal but also the things(waste) which is used to treat a wound of a person who is infected could drastically cause a Spread. So, Discarding the waste from human living areas soon as possible is an essential part.

C. Garbage Bin Left Unpicked

This problem statement is a commonly occurring Human errors, in some cases the truck drivers might leave garbage bin unchecked or unpicked just having an basic idea that some other truck drivers would have picked the garbage bin, this makes the wastes to rot into serious state in which it is a perfect body or medium for generating or spreading the Bacteria.

III. SYSTEM OVERVIEW

A. Detection Unit

1) Garbage Can's Status: The Weight of the Garbage can is constantly detected to detect the Weight of the garbage can, Typical Street cans will have 175 pound weight limit, and some other large garbage can will have 135 pound Weight limit and Rare case some streets with small number houses will use the garbage cans which carries weight about 85 pounds. Based on the types of the Garbage can the weight limit is programmed. In Some cases an weight object might be thrown into the garbage can so the load cell will decide it has it is filled to avoid this two IR sensors s implanted beneath the covering top of the garbage can so the three data from the sensors could

sense the status with accuracy.

2) Truck's Status: The truck's which collects the Garbage will be implanted with the GPS, for routing the Trucks to collect the garbage in balanced manner and to make sure the garbage cans have been picked properly and nothing left behind.

B. Processing Unit

1) Garbage Can's Status: ESP8266 NodeMCU is used as the Processing unit for detecting the Status of the Garbage, Since it has the ability to connect to the Internet so that could lot easier to work with this system in huge Cities.

2) *Truck's Status:* GPS Module is connected with Raspberry Pi Zero considering It's Compact Size. Raspberry pi Zero is processing unit of the system in the Truck. It will be programmed to find the nearest Full Garbage to Pickup.

C. Organizing or Monitoring the System

A Server which has the access to Both the processing unit In truck and other in the Garbage can. This Server allocates the route for trucks to pickups, this system avoids the repetition of the trucks in picking up and also leaving the cans behind.

IV. BLOCK DIAGRAM

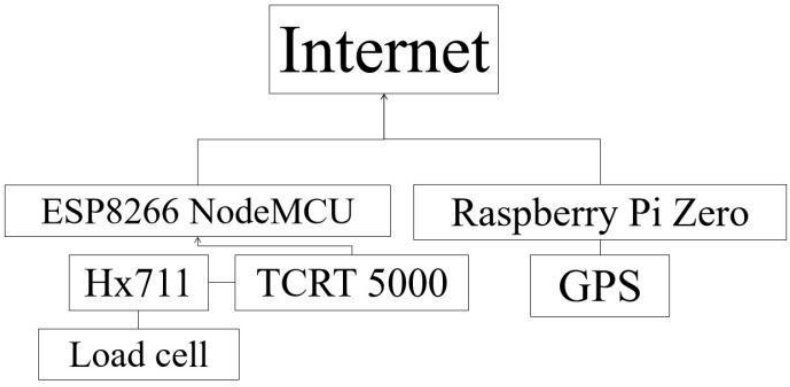

Fig 2. Block Diagram of Working

As it shows clearly that the system is connected to the internet and works synchronously with each other in the system. To make it economical the the bin is designed with ESP8266 NodeMCU wich is connected to the Load cell and the IR in the Bin. The MCU is connected to the internet. Using an Pre-built server the raspberry pi in the truck and the MCU in the bin connected. The Raspberry pi in the truck is connected with an GPS Module for the process.

V. WORKING AND OPERATION

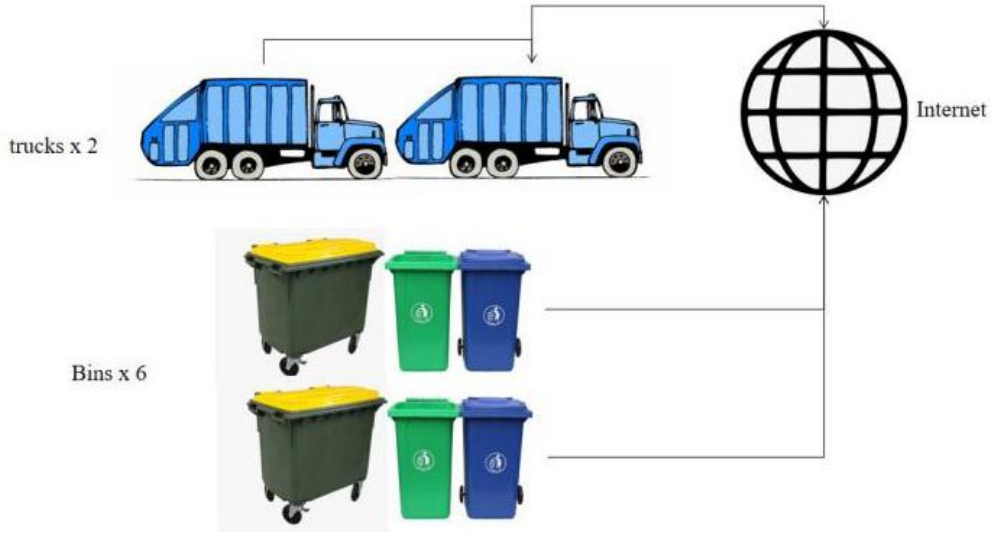

Fig 3. Working Representation

A. Self analyzing Garbage Bin:

Using the proximity and load sensors in the Bin, the status will be detected. Technically the proximity is enough for system to run properly but to avoid the false alarms the system is customized with an additional sensor to detect the weight the Bin which is Load Cell.

B. Systematizing the waste Management:

The status about the Garbage Can whether the can is filled or empty will be detected using the proximity and load sensors implanted in the Garbage can will be sent to the server in which the entire system is connected to. The Real Time Location of the Trucks will be streamed to the server, the server will relay the information to the Truck.

D. Routing the truck:

Raspberry pi zero is implanted to the garbage picking truck, it tracks the location of the truck, transmit the information regarding the filled garbage can to the nearby garbage truck. Based on the Bins Containment status the required number of trucks to pick can be detected earlier, this will reduce the fuel expenses and also the workers expenses. The system will also intimate the empty trash bins before the driver stops the truck for the pick, this will save the time.

VI. FABRICATION AND IMPLEMENTATION

The Two IR Proximity sensors is implanted in the wide way of the Door of the Garbage Can, Thanks to the Plastic Technology for Synthesizing materials like acrylonitrile-butadiene-styrene (ABS) this material is less in Cost and its even available in the typical Markets, this Cost around 70 to 110 per Kilogram in Indian Rupees.Importantly this Material as Chemical and thermal stability and also for the Strength and Toughness. This Material Can be used as the layer to cover the Proximity, ESP8266 NodeMCU and Battery set. The photo emitter and receiver will be let open for detecting. A Small Cavity inside the Garbage can all over the bottom of the Can, inside in which the Load cell is implemented along with the Hx711 the output wire is connected to the ESP8266 NodeMCU which is the Top of the can, the electricity required for the load cell to rum is taken from the Battery which is in the Top of can.

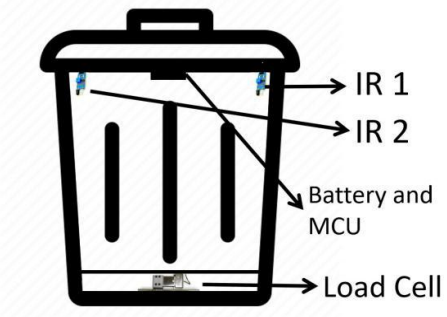

Fig 4. Fabrication of Garbage Can

VII. DRAWBACKS

This system can only be more feasible in the rural areas especially in the town sides.

This system is more effective for a huge region.

Considerably, the expenses saved using this system is just little higher than the expenses of the Implementation. Considering many years of this system usage, it will save lot of expenses.

VIII. FUTURE WORK

When the smart waste management system was spread all over the cities, it is quite serviceable to acquire and analyse the annual statistical records regarding, the counts of evacuated trash can, the amount of trash which has been taken away by a garbage picking truck in every cities and the quantity of trash produced by every single city has been taken into account to inspect and control the major trash producing cities to prevent the global pollution. Meanwhile all the above mentioned data are dumped into a pre-built website. It not only plays a role of platform to access data but also it automatically updates the data accordingly.

IX. RESULT

Hereby the system's requirement and process for the fabrication has been discussed. If the System is Implemented, Time and Fuel, Man power expenses can be reduced and also the Diseases which contracts through flies can also be reduced.

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