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SOT based Dynamic Garbage Management System

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Abstract: At present situation, all would come across many times that the Garbage bins or Dust bins overflows at public places in the cities due to increase of the garbage every day. It creates sanitation problems for the people and bad smell in and around the environment and spreads deadly diseases and makes human ill; to overcome this situation designed a Garbage Information System using SOT (Smart Online Technologies). There are many number of dustbins located throughout the town, city or within a campus. The dustbins are connected with very low-cost device to track with a unique id and the level of garbage in bins by IoT. The PCB is for physical support and wiring. As given unique key, it is easy to identify the bin once it is full which is sensed by proximity sensors. When the level reaches rim limit, the device will start to transmit the level of bin together with its unique ID. Any updates are added as duplicates for original by Blockchain.The details can be retrieved by the corresponding authorities from all the places with the help of SOT and an instantaneous action can be taken to replace the dustbins.

Keywords: SOT, IoT,PCB, Proximity Sensors, Blockchain

I. INTRODUCTION:

Domestic solid waste (DSW) production has rapidly increased in previous years. Since 1960, waste generation has drastically increased by a component of two [1]. The treatment of DSW should be excellently safe and most importantly, it should be environmentally sound. Reduction, reuse, recycling, sorting, segregation, processing, and disposing are major steps of integrated waste management [2, 3, 4]. Currently many health and environmental issues are related to improper waste management in developing countries [3]. One among the foremost common issue regarding old methods of waste management is that the emission of greenhouse and other toxic gases from treatment and disposal procedures [2, 3]. Hence, other alternative for the management of DSW are required.

Excessive use of resources within the economic sector also within the households generates immense quantity of solid waste, which is challenging global sustainability [4]. it's been noticed that with economic improvement in developed countries, the number of waste generation has been drastically increased [5]. consistent with International Bank for Reconstruction and Development global review world cities generates about 1.3 billion tonnes of DSW annually, the quantity is predicted to succeed in 2.2 billion tonnes by the top of 2025 [6] . Poor collection of waste leads deterioration of environmental aesthetics, local flooding, land, air, and pollution [6, 7]. of these results in severe human health hazards, which may only be diminished by executing cost effective technical and policy measures.

Recently many new technologies are introduced to beat the results of poor waste management and human health risks. The selection and application of such technology depends upon various factors including country's economic condition, priorities, and sorts of waste generated [8]. Developing countries like Italy, Japan, USA, and UK are practicing zero waste concept Domestic waste management; they're introducing modern ways of waste collection and storage, methods of incineration, plasma gasification, aerobic and anaerobic digestion, verification, and deep slurry injections [9, 10, 11, 12, 13, 14, 15].

Aside from advance treatment and disposing technologies they're strictly implementing the concept of 3Rs, reduce, reuse and recycle [16]. Lack of experience, financial resources and other legal framework failure are the basis causes of the DSWM problems altogether Asia. the shortage of public awareness is that the main reasons for uncontrolled solid waste disposal and therefore the basic environmental ethics. Developing countries usually concentrate on disposal of waste and thus the most typical way is landfill. This cannot only cause decrease of average landfill life but also pollution and heating tank to the discharge of CO2 and CH4 [8,17,18].Implement latest, environment friendly, and fewer expensive SO technologies so as to take care of the sustainability of planet earth [8,20,21] .

SOT application is network of activities from storage to disposal. To evade the environmental contamination and human health risks thanks to the poor waste management, developing countries should shift towards latest technologies of SOT. The article has briefly covered those latest and innovative technologies of waste management from storage, collection and final disposal.

II. SWACHH BHARAT MISSION (SBM)

Swachh Bharat Mission (SBM), Swachh Bharat Abhiyan (SBA), or Clean India Mission could also be a country-wide campaign initiated by the govt. of India in 2014 to eliminate open defecation and improve solid waste management (SWM). Phase 1 of the mission lasted till October 2019. Phase 2 are going to be implemented between 2020-21 and 2024-25.[22]

SITUATIONAL ANALYSIS SBA is one of the foremost highlighted programme pass by this Government of India. SWOT could also be a basic, analytical framework that assesses what an organization can and can't do, also as its potential opportunities and threats, determines what assists the firm in accomplishing its objectives, and what obstacles must be overcome or minimized to understand desired results. So, the situational analysis was done by reviewing the available literature on subject. Strong points also as weaknesses were identified regarding SBA, then some suggestions got , which may work sort of a chance regarding improvement of sanitation in India. the subsequent five elements to be followed strictly to realize excellent results are:

1. Order of inclination for managing waste
2. Strict Waster Management Standards
3. National Level Planning
4. Responsibility of Manufacturer
5. Use of varied Technologies to encourage prevention and recycling

1. Order of inclination for managing waste

It is best practice to avoid creating waste the maximum amount as possible, recover usable and valuable raw materials and generate energy by reduce to ashes of residual waste. reduce, reuse, and recycle: the order of preference has been the rule from the start and is as follows:

(a) reduce or prevent
(b) preparing for reuse, recycling
(c) other recovery, e.g. energy recovery
(d) disposal

Fig.1. 3R's for effective Garbage Management

2. Strict Waster Management Standards

To reduce the environmental pressure arising from waste management, strict standards are to be introduced.

1. Standards to be framed to guard soil from land filling
2. Standards are set for the building materials quality derived from waste ()
3. Air-quality standards for burning waste

4. Frame quality standards for organic fertilizers from bio-waste
5. A ban on landfill that waste streams suitable for recovery or incineration aren't allowed on landfills

3. National Level Planning

National level awareness is strictly implemented. However, cooperation between the various tiers of state still exists for outlining policies, implementation and enforcement.

4. Responsibility of Manufacturer

Extended producer responsibility means producers or importers are responsible, or share responsibility, for the management of the products that they need or will placed on the market when these products are discarded. This responsibility are often prescribed voluntarily (and where desired supported by the Minister liable for a universally binding agreement on a waste management fee) or through legislation. Instruments for promoting producer responsibility are generally utilized together with other instruments, e.g. the introduction of landfill bans and landfill tax levies.

5.Use of varied Technologies to encourage prevention and recycling

✓ Enforcement of legislation

Without enforcement, waste management simply doesn't work. a complicated waste tracking and monitoring system has been developed to support enforcement.

✓ Financial instruments

Instruments like landfill tax and volume-based waste fee systems help achieve the shift towards less land filling and more recovery and recycling of waste.

✓ Separate collection

A good and approachable collecting system may be a good instrument. There are systems for the separate collection of organic waste, paper and cardboard, plastics and glass.

Furthermore, every municipality must have a location where people can sort and eliminate their waste: the general public amenity centre.

✓ Effective Communication

Raising public and community awareness: communication and education are essential.

Engaging the general public at large and providing the required feedback on the success (or not) of those separate collection and diversion programmes and what it means in terms of environmental quality or monetary savings are instrumental.

III. METHODOLOGY:

Present situation not much attention is paid to waste management and therefore the inefficiencies abound more so with the gathering of waste. Current methods dictate that each one waste bins need to be attended to; whether full or not. this type of collection wastes time and energy because the collectors are getting to bins which don't got to be attended to within the first place. Imagine the prices that the corporate can save by being more efficient. As a public, presumably to encounter overflowing bins thanks to inefficient waste collection.[23]

Components for Implementation:

The components that make up the solution are :

✓ ESP8266 WiFi chip,
✓ Proximity sensors,
✓ li-ion battery (6000mAh),
✓ Printed Circuit Board (PCB)
✓ The Blockchain.

ESP8266: In recent years, ESP8266 had a massive adaptation among DIY enthusiast due to its low cost and high performance 32bit application processor compared to MCU in the same segment along with a integrated TCP/IP stack based WiFi. It has Capabilities such as WiFi hotspot, Peer to Peer Communication and combined mode as a STA and AP. In the context of current implementation is by using firmware programming through Arduino IDE modified for ESP8266 series.[24]

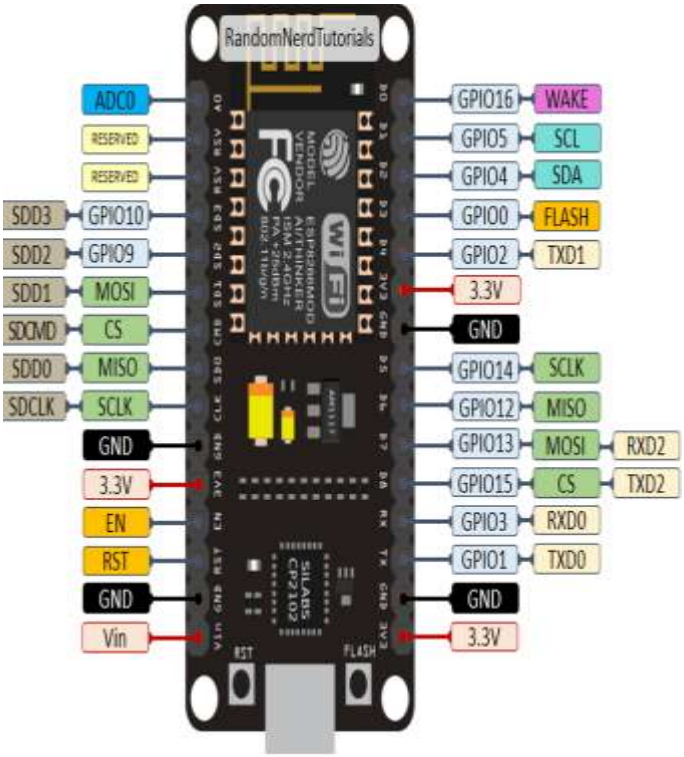

Fig.2: ESP8266

Proximity sensors:

On the proximity sensors, it's a well-known one which may be found behind the foremost cars – the reverse sensor. It'll measure the space from the highest of a waste bin to the closest object inside thus giving an estimate of how full the bin is. Proximity sensing is that the ability of a robot to inform when it's near an object, or when something is near it.[25]

A proximity sensor is an electronic solid-state device used to indicate the presence of an object without making physical contact. The proximity sensor may be a very useful device in hazardous areas like oil refineries and not so hazardous areas like door detection systems. Proximity sensors don't use any sort of physical moving parts instead they permit signals to transmit through them when something that's being monitored comes in close proximity of the sensing area. Despite the method, they're still mentioned as proximity switches. Proximity sensors are to be used when the thing that must be detected is just too small, lightweight or too soft to work a mechanical switch. When there's a requirement for rapid response and high switching rates like the counting objects, proximity sensors are ideal for the task.

Proximity sensors should even be used when there's a requirement to sense material through nonmetallic barriers like glass, bottles, plastic, or paper cartons or when working in hostile environments that demand electrical isolation from the merchandise being monitored. Proximity sensors also are needed when there's a requirement to possess a tool that gives long life and reliable service or when there are vast electronic control systems that require to be freed from chattering contacts to supply an accurate analysis of what's being monitored. There are two main sorts of proximity sensors that achieve these need, these include the inductive and capacitive proximity sensors.

Inductive Proximity Sensor

The inductive proximity sensor as seen in Figure 3 (a) is employed to detect both ferrous metals that contain iron and may be magnetized and nonferrous metals like what wont to conduct electricity and copper.

Fig. 3 (a): Inductive Proximity Switch

Inductive proximity sensors operate under the electrical principle of magnetism when a fluctuating current induces the voltage during a target object. [26]

Capacitive Proximity Sensor

The capacitive proximity sensor is analogous to the inductive proximity sensor, as shown in figure 3 (b). The most difference between two is capacitive proximity sensor produces an electric field rather than a magnetic flux and therefore the sensing area of the capacitive proximity sensor are often actuated by both conductive and non-conductive materials. A capacitive proximity sensor contains a high-frequency oscillating circuit in conjunction with a sensing surface formatted by two metal plates. When an object or some sort of material gets within the sensing range it disturbs the electric field of the metal plates, changing the capacitance of the proximity sensor, this alteration leads to a change of state within the operation of the proximity sensor.[26]

Fig. 3 (b): Capacitive Proximity Switch

Li-ion Battery

A Lithium Ion (Li-Ion) battery may be a rechargeable battery with twice the energy capacity of a Nickel-Cadmium battery and greater stability and safety. [27]

Fig.4 Li-ion Battery

Printed Circuit Board (PCB)

A circuit board (PCB) is that the board base for physically supporting and wiring the surface-mounted and socketed components in most electronics. In applications where fine conductive traces are needed, like computers, PCBs are made by a photolithographic process, during a bigger scale version of the way conductive paths in processors are made. [27]

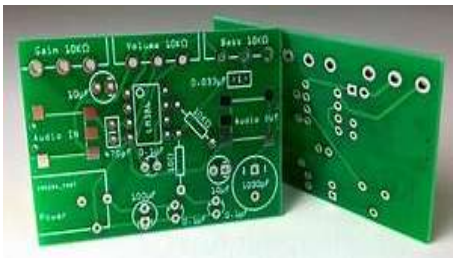

Fig.5 PCB

The Blockchain

The storage of waste management history and logs is done on the Blockchain and decided to go with Tangle from IOTA. Blockchain of Things (BCoT): Fusion of Blockchain and Internet of Things. Similar to IoT, Blockchain technologies have also gained tremendous popularity since its introduction in 2018. Even though Blockchain was first implemented as an underlying technology of Bitcoin cyrptocurrency, it is now being used in multifaceted nonmonetary applications [28]. Miraz argues that both IoT and Blockchain can strengthen each other, in a reciprocal manner, by eliminating their respective inherent architectural limitations [28]. The underlying technology of IoT is WSN. Therefore, analogous to WSN, IoT also suffers from security and privacy issues. On the contrary, the first reason for Blockchain's implementation trend in nonmonetary applications is thanks to its inbuilt security, immutability, trust and transparency. These attributes are powered by Blockchain's consensus approach and utilization of Distributed Ledger Technologies (DLTs) which require extensive dependency on participating nodes. Therefore, the fusion of those two technologies Blockchain and Internet of Things (IoT) conceives a replacement notion i.e. the Blockchain of Things (BCoT) where Blockchain strengthens IoT by providing extra layer of security while the "things" of IoT can function in participating nodes for Blockchain ecosystems [28]. Thus, Blockchain enabled IoT ecosystems will provide enhanced overall security [30] as well as benefit from each other.

Implementation:

The sensors within the bin measure how full the bin is. This information is relayed by WiFi to cloud monitoring and analytics platform where their customers can access in real time. Waste collectors then go on their rounds based on the feedback from the monitoring platform and presumably only the full bins are attended to.

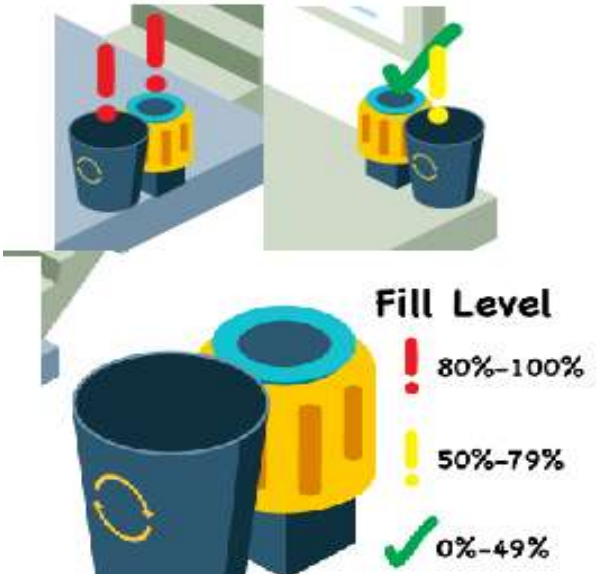

Fig.6: The Level of garbage filled in Bin

In essence, aim is to achieve the waste collection planning and implementation (dynamic routing for trucks and personnel), transport of waste to specific locations (e.g., routing consistent with the sort of waste),

IoT and IOTA

Waste management is indeed an untapped area for IoT and one where it's the potential to grow. Couple that with the integration with Blockchain technology (IOTA) and start to see that both go hand-in-hand.

IV. CONCLUSION AND FUTURE WORK:

Due to open, uncontrolled and poorly managed waste dumping in many metropolitan cities of developing countries, serious environmental degradation occurs. Approximately 90% of the waste is disposed of in open dumping areas. Recently developed countries have executed the zero-waste concept which is encouraging latest technologies. On the other hand, in most developing countries waste management is a matter of least worry, which causes severe environmental and health issues in those countries. The implementation of SOT can reduce the short and long term environmental and human health hazards. The article concluded that proper implementation of latest technologies in the sector of Garbage Management can play a very important role in providing pollution free and sustainable environment. If implemented in shopping malls, airports, colleges i.e in small scale and assured that the next bin encountered isn't full. The data to be collected and it must be implemented in the large scale for the assurance of trash free environment. Creation and visualization of SMART DATA produced by intelligent hardware software systems, autonomous and transparent system are to be implemented in future.

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