IoT Enabled Coherent Detritus Management

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Abstract – Technology has reached and has modified and manipulated almost every part of us human beings. But technology seems to lag behind in developing and enhancing the waste disposal system. The waste disposal system is very ancient and outdated. As a result, the nation lags behind in waste recycling and management system, while countries like Denmark have achieved perfection to an extent such that it has begun importing waste from other countries to keep their recycle plants running. Hence this paper is aimed at modifying one significant part of waste management that can prove to improve the efficiency of waste management. Usually, the Waste Trucks will scavenge streets after garbage bins and will collect the waste. But this happens at irregular time periods. Sometimes a road is visited after the Bin overflows with garbage and a complaint is raised to the corporation. This has a lot of disadvantages as wastes are not properly managed, the bins overflow with scraps and litter the surroundings; traffic ensures as the truck blocks the road at random times. To combat this issue, we propose an idea where we enhance the waste bins by featuring it with a level indicating sensor integrated to the internet using Wi-Fi Module. The whole setup is connected to a central microcontroller. Likewise, all the Bins in an area are given the similar configuration, and these are interconnected wirelessly. Each area is distinguished and is given a separate new identification in the 'Coordination Controller.' This is a web portal designed precisely where all the data of the bins are accumulated online in this portal. So by a pre-fed algorithm, the Coordination Controller will be able to determine which area needs immediate attention. The trucks will be fitted with a GPS sensor, and an App-enabled PDA will be handed to the driver. So when an area needs immediate attention, the nearby truck is notified immediately. The algorithm prioritizes areas on a basis like Schools; Hospitals are given high priority, while the less critical area is given least priority. It will be able to analyze which area requires regular attention based on the history and will provide it with a high priority. So if a particular area has a maximum waste generation, based on a pattern that area will be offered primary priority. So when the level of a bin reaches a maximum, it'll be immediately reported through the Coordination Controller to the nearby truck and that particular container is emptied. This method is Simple, Cheap and easy to implement. This will benefit over the older process in many ways. The wastes are managed efficiently, regular collection ensures. Littering and overflow of waste is prevented. Schools and Hospital areas can be kept clean. An Arduino UNO Microcontroller, Wi-Fi Module and the level sensor will be able to change the way Waste is managed.

Keywords – Arduino, Controller, Dijkstra, Priority Estimation, Ultrasound

I. INTRODUCTION

Technologies seem to trail behind in amplification and enhancement of waste clearance system in numerous nations. The waste management system which is being imploded is very ancient and outdated. This is due to a lack of the advancement of waste disposal methods. A recent survey has recorded that India has the poorest waste clearance methodology. But with the technologies and machinery available this disastrous situation can be elucidated. Several demerits which have stemmed up can be solved and by the implementation of this technology, it will result in a huge impact on the development of the nation's reputation.

II. CONTROLLER

Microcontroller acts as the heart of the system for every waste bins. The whole setup needs to be perfectly connected to function efficiently. Arduino UNO Microcontroller has a high-performance Microchip 8-bit AVR RISC-based microcontroller chains 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF

packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device activates between 1.8-5.5 volts. Implementing powerful commands in a single clock cycle, the device attains throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed. This will make the structure simpler, function efficiently produces the intended output in an effective way.

III. LEVEL INDICATION

We enhance the waste bins by featuring it with a level indicating sensor integrated to the internet using Wi-Fi Module. Ultrasound sensor can be used as a level indicating module, where placing the sensor at an appropriate point in the waste bins. Ultrasound waves are emitted will get reflected when the load is stored in the bin. The output of level indicating sensor will indicate how much load is being stored in the bins placed in appropriate places across the city. Thus by this method, we will be able to monitor the number of wastes that is been filled in the bins. Once a bin is filled to an extreme amount, the microcontroller will notify a message that the bin needs to be cleared instantly. The level indicating sensor is interfaced with the microcontroller, where all the data is stored and transmitted.

IV. IOT ENABLED SERVER

A Cloud server will be maintained where all the data from each of the microcontrollers are fed wirelessly through a WiFi module interfaced to the Arduino. The data from the level sensor, proximity sensor, GPS, will be uploaded and data will be throttled back in real time. Each of the devices should be constantly connected to the internet over the working duration. A simple Linux based cloud network will be used as Virtual Private Server which will allow it to be exploited for the length of IoT applications. This will enable the devices to connect to the network and thus will allow manipulation wirelessly. Operating via TCP/IP clients, the network connection will be made easy and router port forwarding is necessary. Code complexity is greatly reduced and smaller devices with lesser power will be able to even browse effortlessly.

V. PRIORITY ESTIMATION

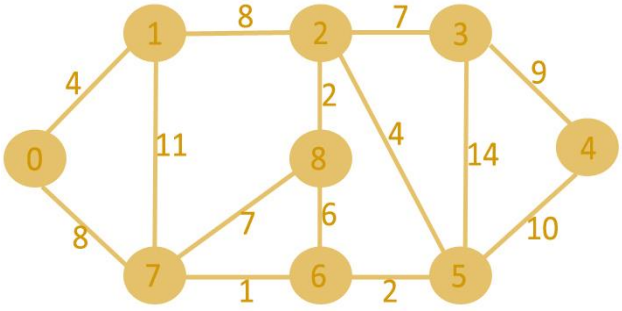
This method will prioritize the areas that need immediate attention by working on the data gathered from the sensors of the devices. The collection order will be based on this priority. This is made to ensure that the areas that frequently require attention are first taken care of, followed by the least priority areas. The priority is found by identifying the most number of devices that have indicated full within an area. A number of devices are marked for a particular area and a threshold value is set based on which the priority is marked. The priority is calculated using the formula –

$$\text{High Priority} = \text{if } \frac{\sum \text{No. of Full Bins}}{\sum \text{Total Bins In that Area}} > 0.75$$

If the threshold is set to 0.75, then if within an area, the High priority equalizes or exceeds this value, then this area is placed into the priority order. The priority order is sorted in decreasing levels based on the result of the high priority.

VI. OPERATOR LOCATION USING DIJKSTRA ALGORITHM

After marking and identifying the high priority areas, the truck operator must be chosen automatically by the server to the appropriate nearest areas. A time will be allotted to the operator for each area based on the traffic update from Google Maps, so that the operator may collect at a proper time without causing obstruction to the vehicles. For this, we employ the Dijkstra algorithm. The Dijkstra algorithm is used to find the shortest path between a number of points on a graph. It is used when the target destination is static and the locator is dynamic in motion. Thus during motion, when there are a number of points, it selects one target such that from any direction it is the shortest distance. So if the locator moves towards the target point, the algorithm will still find another shortest distance from the location the locator is present.



For example in this problem, the nearest point from 0 will be chosen as 1 and 7. After that, the values will be updated to 2 and 6 and so on.

VII. GPS COORDINATES

So after the nearest truck operator is located, the server will ping the location to the operator and the shortest GPS route will be suggested to him. Based on the traffic updates, the most optimal time will be fixed for the operator to collect the garbage. The operator will be able to navigate to the device using the navigation suggested at the optimal time. After collection, the level indicator will return back to normal and will stop its full-alert. Thus when most of the devices have returned back to normal state in an area, that area will be moved to a low priority list.

VIII. LITTER WARNING

A Proximity sensor is used to detect the nearby obstacle and with the input from the sensor appropriate actions must be incorporated. A proximity sensor attached below the bin with min range of 1 meter will detect if any object is around it for more than 5 seconds. On detection, it will immediately capture an image and will display on the LCD screen and will give a textual warning. When anything comes in the range of Proximity sensor it flashes out infrared beam and monitors reflections. When sensor senses echo it approves that there's an entity neighboring. The proximity sensor is a device which senses articles near without any physical contact up to nominal range or sensor's vicinity. The sensor also converts data on the movement or presence of an object into electrical signals. When this object is been sensed it activates the controller which is interfaced to the whole system and will be triggered. From the output from the sensor, let's assume its high sensing an object within the sensor range simultaneously three actions takes place instantly. The controller will trigger a camera to shoot a photo of the initial situation when the object is sensed and then the picture is displayed on the LCD screen. The controller will also send a warning message has coded by the user on LCD screen which is placed in a visible area along the bin. It will give a warning message indicating with a sound that comes out from the buzzers with a delay time of every 5 seconds.

IX. CONCLUSION

Using this methodology by integrating IoT with waste management, the system will be greatly optimized and the system will be highly efficient. In most of the countries, waste management is a serious issue as most of the deadly diseases are caused due to poor management of waste. Countries like Austria, Netherlands, Denmark have mastered waste management to a greater level. So all the nations in the world must be implementing better waste management systems to ensure a better and healthy scenario for its citizens.

X. ACKNOWLEDGEMENT

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