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DESIGN AND DEVELOPMENT OF SMART BIN FOR HEALTHY NATION

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Abstract: ***In this paper, we presented the smart waste-bin for clean and healthy nation in the smart city project by using Internet of Things. The system also adapt with network environment, to manage all information from waste management. By using this kind of garbage collectors will be resulting in saving the fuel, work hours and money. In this approach, sensors are placed in the bins located at public areas, to sense the level of the garbage in the bin, bacteria status, gas level, weight of waste content inside the bin. When garbage reaches the threshold limit, the status of the bin is updated in the cloud, and this status can be accessed by the concerned authorities and an immediate measure can be taken for the cost-effective disposal. So, continuous monitoring of garbage bins will helps to keep environment clean and safe. As well as this smart bin reports the bacteria status inside of the bin, for avoiding the infection of bacteria's floods from the bin. As the result we proposed a prototype of smart waste-bin that suitable for many kind of conventional waste-bin.***

Keywords: Smart City; Smart Waste-bin; Waste Management; Load Cell; Sensors;

I. INTRODUCTION

A Smart City is a city development to manage multiple information and communication technology in order to make a solution for any problem in the city. Smart city includes many information such as, local department information system, schools, libraries, transportation system, hospital, power plants, law, traffic system, waste management, and others city services. The goal of a smart city is to improve an efficiency of services and connect all information into one system. Nowadays, development of communication technology especially internet of things (IoT) allow the city to be developed into a smart city. The aforementioned concept is being realized through the use of real-time systems and sensors, where data are collected from citizens and objects (things), then processed in real-time and finally the gathered information and related extracted knowledge are becoming the keys to tackling inefficiency.In this context, waste management involves numerous waste bins that exhibit significant filling variations (over days and seasons or location) and diverse requirements foremptying, from sporadic (a few times within a week) to veryfrequent (several times a day). On the other hand, other wasteforms (i.e. agricultural, biomedical, chemical, electronic,mineral, organic/inorganic, and radioactive, etc.) arecharacterized by specific collection points, uniform andpredictable production, and equal, usually long, filling periods.The detection of the fill-level for urban solid-waste-bins presents many difficulties due to the various irregularities of the waste-bin filling process, such as the irregular shape and the variety of the included materials. More challenges exist for the economical and energy efficient data aggregation from a large number of bins, as the harsh environmental conditions (e.g., humidity, temperature, and dust) can significantly affect the sensor measurement accuracy and reliability, while on the other hand these conditions constitute parameters that one should also take into account for a holistic waste management process.

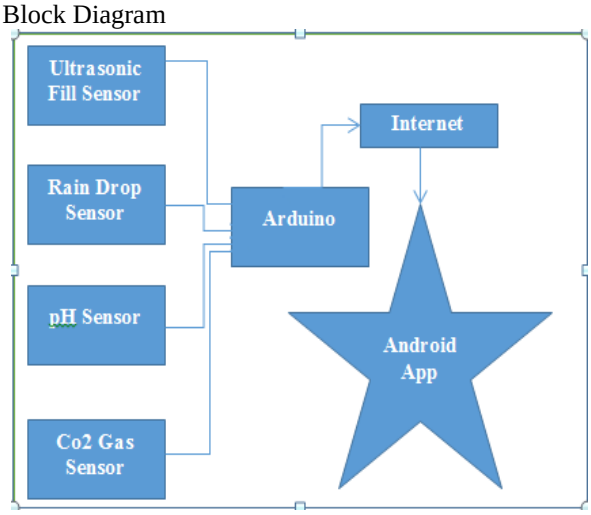
II. PROPOSED SYSTEM

In this section there is description of the details of overall proposed system.

A. Problem Statement

The accusative of the proposed system is to design the smart bin for controlling bacteria diseases. The smart word not only reduces efforts, but also reduces power expenditure. Now a day's health is very important so keeping
this in mind the nominated system will help in keeping in line various diseases caused by bacteria. This automated system will help the produce clean and healthy nation.

B. Block Diagram



Ultrasonic fill sensor: To measure the level of waste in the smart bin we used ultrasonic sensor attached in the top of the bin. The ultrasonic sensor is providing ranging measurements independently of the contained objects, thus making possible the corresponding translation into fill level measurements. Moreover, ultrasonic sensors are most suitable to this application because they can be placed on the lid and thus avoiding harsh conditions of the

maincompartment. Finally, the chosen ultrasonic sensors can have a beam with a wide field of view and therefore the whole bin can be sensed with a limited number of sensors, thus reducing cabling and interconnection needs. This sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit.

Rain drop sensor:This sensor basically a board on which nickel is coated in the form of lines. It works on the principal of resistance. When there is no rain drop on board, resistance is high so we gets high voltage according to V=IR. When rain drop present it reduces the resistance because water is conductor of electricity and presence of water connects nickel lines in parallel so reduced resistance and reduced voltage drop across it.

pH sensor:pH is the numeric representation of gram-equivalent per liter of hydrogen ion concentration in any solution. It varies between 0 to14. It is the logarithmic measurement of moles of hydrogen ions per liter of solution. The solutions having pH value between 0 to 7 are acidic solutions with large concentration of hydrogen ions whereas solutions having pH value between 8 to 14 are basic solutions with small hydrogen concentration. The solutions having pH value of 7 are neutral solutions. Measuring the pH gives the measure of alkalinity or acidity of a solution.

pH meter basically works on the fact that interface of two liquids produces a electric potential which can be measured. In other words when a liquid inside an enclosure made of glass is placed inside a solution other than that liquid, there exists an electrochemical potential between the two liquids.

Bacterial infections are one cause of foodborne illness. Nausea, vomiting, diarrhea, fever, chills, and abdominal pain are common symptoms of food poisoning. Raw meat, fish, eggs, poultry, and unpasteurized dairy may harbor harmful bacteria that can cause illness. Unsanitary food preparation and handling can also encourage bacterial growth. Bacteria that cause food poisoning include:

- Campylobacter jejuni (C. jejuni) is a diarrheal illness often accompanied by cramps and fever.
- Clostridium botulinum (C. botulinum) is a potentially life-threatening bacterium that produces powerful neurotoxins.
- Escherichia coli (E. coli) O157:H7 is a diarrheal (often bloody) illness that may be accompanied by nausea, vomiting, fever, and abdominal cramps.
- Listeria monocytogenes (L. monocytogenes) causes fever, muscle aches, and diarrhea. Pregnant women, elderly individuals, infants, and those with weakened immune systems are most at risk for acquiring this infection.
- Salmonella causes fever, diarrhea, and abdominal cramps. Symptoms typically last between 4 and 7 days.
- Vibrio causes diarrhea when ingested, but it can also cause severe skin infections when it comes in contact with an open wound.

MQ2 gas sensor: This sensor module detects gas leakage in smart bin. In this gas sensor use a small heater inside an electro chemical sensor. They are sensitive to a range of gases. The output is an analog signal and can be read with an analog input of the Arduino.The MQ2 has an electrochemical sensor, it changes the resistance for different concentrations of varied gasses. The sensor is connected in series with a variable resistor to form a voltage divider circuit and the variable resistor is used to change sensitivity. The change in the resistance changes the voltage across the sensor, and this voltage can be read by a microcontroller. The voltage value can be used to find the resistance of the sensor by knowing the reference voltage and the other resistor's resistance. The sensor has different sensitivity for different types of gasses. They are useful in gas leakage deduction LPG, propane, methane, Alcohol, Hydrogen, I-butane and smoke. The sensor sensitivity can be adjusted by using potentiometer.

Microcontroller: The Arduino Uno R3 is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serialdriver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

Waste Management:

 GSM Module: A GSM module is used to communicatewith server. It will send periodically the information ofwaste weight and bin capacity. When waste-bin is full itwill send directly notification for worker to pick the waste.

 Bluetooth: Bluetooth is attached for short rangecommunication. It is used by the worker for maintenanceshould there is system fault. It also communicates with theapplication to get the data if GSM module has a problem.A bluetooth connect trough a mobile application and shareinformation about the weight of waste in waste-bin.

 Mobile Application: For efficient waste management, amobile application is also made to help worker picking andmanaging the waste bin. The notification sent from GSMmodule also came up in mobile application. So it can makethe handle of a fully waste-bin faster. We used app inventor
to develop a mobile application running in androidplatform.

 Web-based Monitoring: Web-based monitoring is the placethat all data from all waste-bin is managed. It will show thegraphic daily, weekly, monthly, and yearly about thenumber of waste in all the city. Development of thewebsite use code igniter, while php and mysql are used for the database.

III. RESULTS AND DISCUSSION

The following results are observedfrom this work-

- Detection of garbage level in the bin
- Detection of Bacteria and Gas inside of the bin.
- Wireless transmission of information usingArduino
- Real-time data can be accessed through theCloud
- Overflow of the bins can be avoided

This IoT based garbage management is very useful for smart cities in different aspects. We have seen that, in cities there are different dustbins located in the different areas and dustbins get over flownmany times and the concerned people donot get information about this. Our systemis designed to solve this issue and willprovide complete details of the dustbinlocated in the different areas throughout the city. The concerned authority can access theinformation from anywhere and anytime toget the details. Accordingly they can takethe decision on this immediately.

IV. CONCLUSION

Through this paper we intend to propose a technological process for waste management system. We have seen that, in cities there are different dustbins located in the different areas and dustbins get over flown many times and the concerned people do not get information about this. So we started from smart waste-bin. By using network environment, the real time accurate data from the implemented system could be used for the efficient solid waste management system. Our system is designed to solve this issue and will provide complete details like level, bacteria status, gas level of the dustbin located in the different areas throughout the city. The concerned authority can access the information from anywhere and anytime to get the details. Accordingly they can take the decision on this immediately. The use of solar panels in such systems may reduce the energy consumption. Such systems are vulnerable to plundering of components in the system in different ways which is the scope for the future work.

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