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IoT based Intelligent Bin for Smart Cities using Raspberry Pi

Dr. S. Poornachandra[1], R. Bhuvaneshwari[2], V. Nivedha[3], T. Sornambika[4]
[1]*Dean and Professor, Department of EIE, SNS College of Technology, Coimbatore, India*
[2] *UG Scholars Department of EIE, SNS College of Technology, Coimbatore, India*
[3] *UG Scholar, Department of EIE, SNS College of Technology, Coimbatore, India*
[4] *UG Scholar, Department of EIE, SNS College of Technology, Coimbatore, India*

Abstract: ***Internet of Things (IoT) is a prominent technology that creates a massive network of things communicating with one another. Cities in the world are becoming smarter and smarter by implementing the things using IoT. Smart cities include traffic control, tracking of human activities, monitoring street lights etc. Main objective of smart cities is to keep the environment neat and clean. But this objective is not fulfilled without the waste bin management system. Improper disposal of waste leads to diseases like dengue, malaria to the human society. To reduce this impact, Municipal Corporation has developed a mission named as Clean India mission, which is run by the government to clean the street and other infrastructure. But this system does not clearly explain about the monitoring of bins at different locations. In existing method, municipal person will collect the waste from every bin, whether the bin is filled or not, and will be sent by truck for disposal. This has the major disadvantage of unnecessary transportation and pre-clean-up. In our proposed project, the above disadvantage is overcome. The level of the dustbin will be monitored and the concern person will be intimated through the text message to avoid the overflow of waste and unnecessary transportation of waste pickup truck.***

Index Terms: Raspberry Pi, sensors, GSM, Arduino UNO

I. INTRODUCTION

This project uses the concept of Automation used in the domain of Public Cleanliness and Hygiene. Careless trashing of garbage onto the roads is a common scenario to be found in all developing countries.

Garbage accumulation is so high that it becomes a crisis if left uncollected. If the garbage collector does not turn up, a household would probably direct their maidservant to pick the bags of trash, as it would be too much for the bags to be kept inside the home. The servant would probably dump the trash at the end of the lane.

Having seen that, others would follow that. The place would gradually turn into a garbage dump yard, which would turn into a heaven for deadly diseases. Inefficient waste collection systems lead to environmental pollution, which in turn results in breeding of insects, animal scavengers and rodents, and giving rise to range of diseases. The traditional method includes burning of the waste if not collected in time. Burning of waste causes air pollution to great extent. Uncontrolled release of methane by an aerobic composition of waste also adds in social health issues.

Waste is an important issue, which needs to be tackled smartly. The waste is segregated at our homes for easy at processing and reycling. We observed trash vans or trucks come irregular to homes creating a havoc of households. Due to this many civilians empty their overloaded dustbins in open spaces. This in turn increases environmental pollution. They got inspired from “Swachh Bharat Abhiyan” which is a national campaign by the Government of India, to clean the streets and infrastructure of the country. The citizens want to have better service at a lower cost and having easy accessible reports on what has been done. Hourable Prime Minister Narendra Modi wish to have “Swachh Bharat” (clean India) by 2019, but sweeping the streets does not address the enormity of India’s real garbage challenge. The campaign was launched on 2nd October 2014, on the occasion of Mahatma Gandhi’s birth anniversary and is expected to be completed by 2019, on Gandhi’s 150th birth anniversary. In this point of view this Swachh Bharat project can be done even more effectively with the help of IoT. Without Internet no one can move ahead in today’s world. Thus Internet of Things is the major concept which can be used for garbage monitoring system.

II. OBJECTIVE

The main objective of our project is to monitor the level of the garbage bin to reduce environmental pollution, resulting in a healthy surrounding.

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III. PROPOSED MODEL

A. Block Diagram Explanation

Garbage management is the assorting, transporting, processing, reusing or eliminating and monitoring garbage materials. Garbage management is very crucial and it has become one of the major issues due to high population density. The proposed project is developed for detecting the level and monitoring the bin frequently.

B. Transmitter

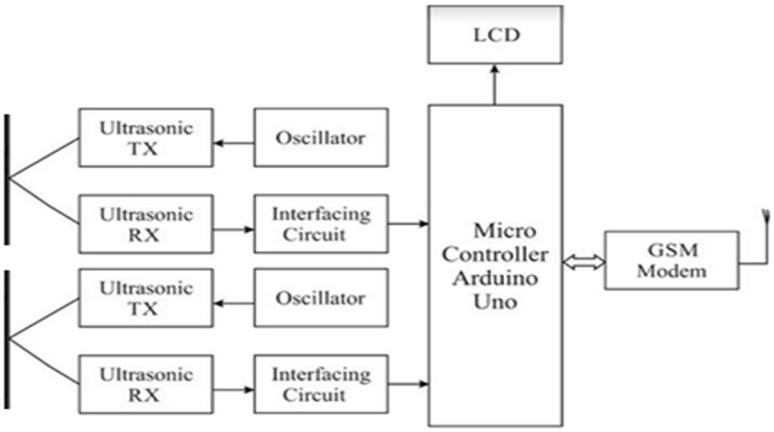

Figure 1 (a) is the block diagram of the transmitter part of the proposed methodology which explains about the garbage monitoring process. Initially power supply is given to the Microcontroller Arduino Uno. The driver circuit consist of 9V step down transformer. The prime function of step down transformer is to step down 230V AC to 9V AC to avoid the high inrush of current which may damage the circuit. From the transformer the current passes to bridge rectifier to which is the arrangement of four or more diodes in a bridge circuit configuration which provides the same output polarity or either input polarity. It is used for converting Alternating Current input to Direct Current output. Further it has 120µF capacitor which is used in power supplies where they smooth the output of bridge rectifier. A heat sink reduces the heat of the devices temperature at optimal levels. A 50µFcapacitor is used to reduce the noise and an LED is for indication of current passing to the circuit. A GSM Transmitter is connected with the Arduino. Once the threshold value at the sensor is reached the GSM transmits the signal to the receiver part of GSM which is connected to the Raspberry pi.

C. Receiver

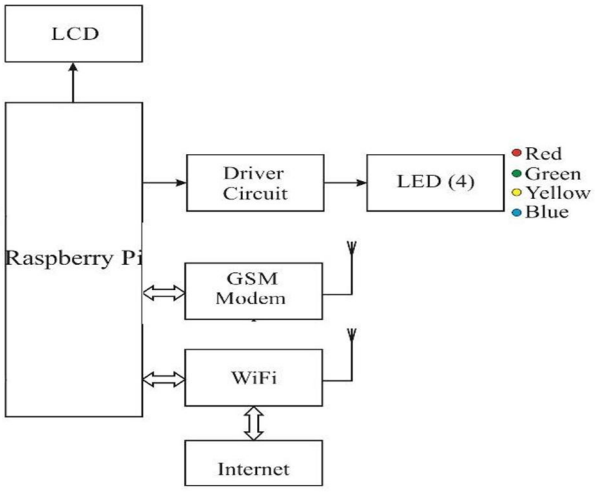

Fig 1(b) Receiver

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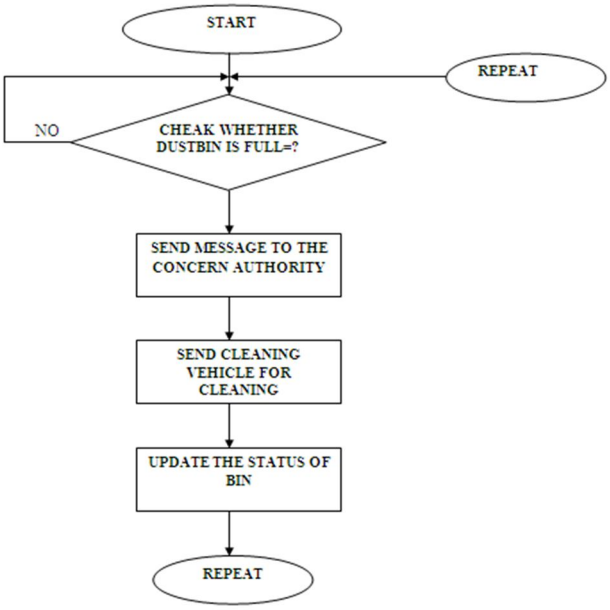
Figure 1 (b) is the block diagram of the receiver part of the proposed methodology The receiver part consists of driver circuits which consist of step down transformer, 5V voltage regulator and capacitors. Four LEDs are used to indicate the level of garbage bin. GSM Receiver part is connected to the Raspberry Pi. Once the signal is reached from the transmitter the receiver section sends the message to the municipal authority.

D. Algorithm & Explanation

This is process flow algorithm for our proposed project.

1) Initially the level of the bin will be detected by the ultrasonic sensor
2) The ultrasonic sensor monitor the level of the garbage bin to reach the threshold value
3) When the threshold value is reached the message will be sent to concern municipal authority.
4) The municipal authority will intimate the concern person to clean the garbage that is filled.
5) Then truck reaches the particular location empty the bin.



IV. CONCLUSION

Using the advantages of IoT we proposed system which includes implementation of ultrasonic sensor, Raspberry pi and Web server. This system assures that whenever anyone puts the trash in the dustbin, it automatically intimates the concern Authority. It also helps us to reduce pollution. Implementation of managing the garbage using sensor, Raspberry pi and Web server is displayed in this project. This project gives solution of how garbage management can be achieved. This method helps in keeping the waste bin clean when the bin is completely filled. Hence better facility of collecting garbage and transportation should be provided. Since, this system provides the information when the bin gets completely filled with garbage, it reduces the number of times the arrival of vehicle which collects the garbage. Apart from previous versions our project we have included two gsm modules that pave way for transmission and receiving of signals. This method finally helps in keeping the environment clean. Thus, the garbage collection is made more efficient.

A. If this concept implemented, will reduce the unhygienic conditions and will make the processing of garbage very easy.
B. Need of smart cities concept.
C. Various features such as durability, affordability, prevention against damage and maintenance issues is kept in mind while designing the dustbin. Implementation of these Smart Dustbins can prevent the overflow of garbage along the roadside to a great extent thereby controlling the widespread of many diseases. It can prevent pollution and also prevent the consumption of the spread out garbage by the street animals. This Intelligent Dustbin can contribute a lot towards a clean and hygienic environment in building a smart city.

V. RESULT & ANALYSIS

The following result is obtained from our proposed methodology

A. Dustbin level is detected
B. Data is transmitted in real time and accessed frequently
C. Overflow of dustbin is reduced
D. Send message to municipal authority through Way 2sms

When the garbage is filled inside the dustbin the ultrasonic sensor sends the message though network to municipal authority. The message will be sent only if the ultrasonic sensor reaches the threshold value. Due to this the transportation is reduced and time is saved.

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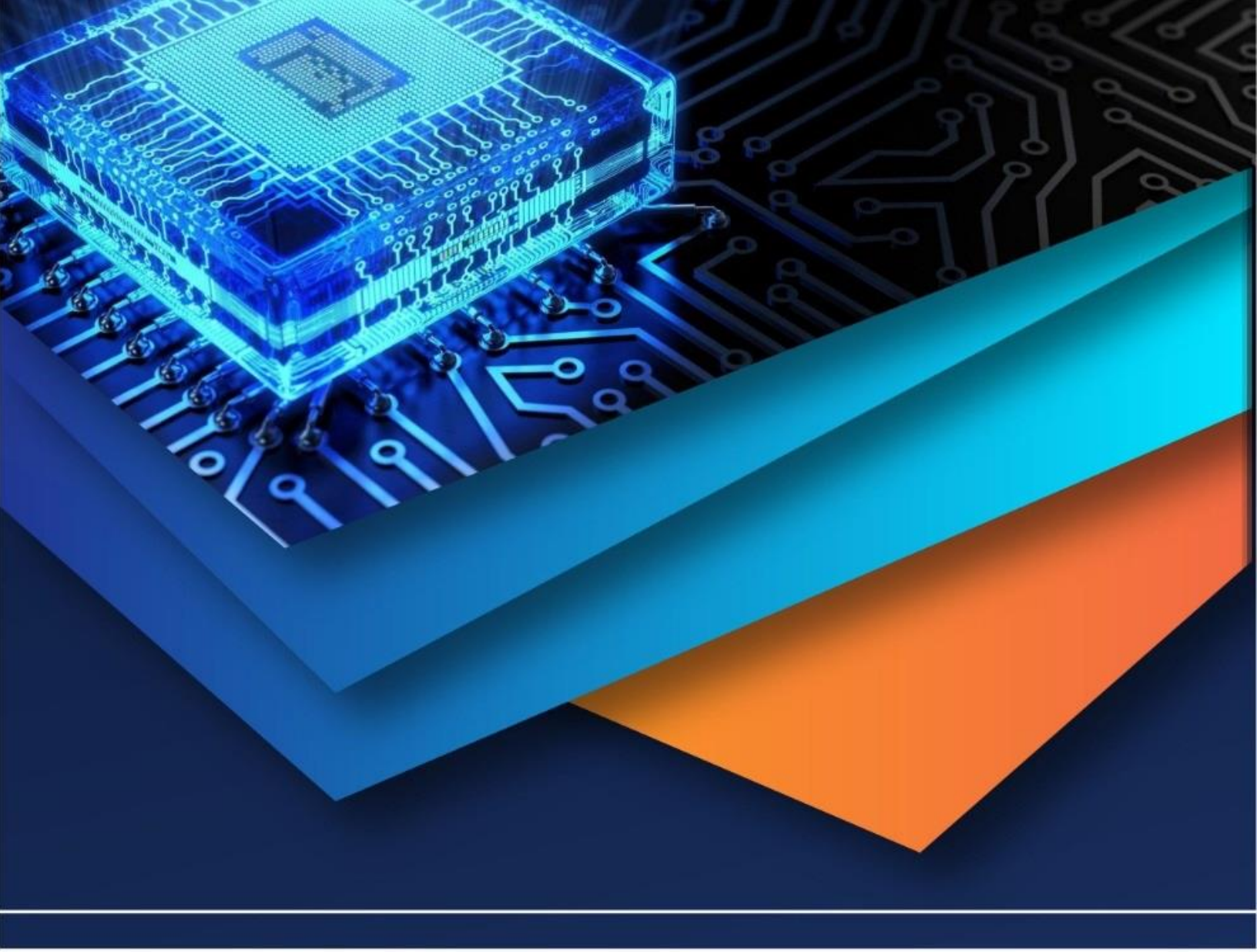

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