IOT GARBAGE MONITORING SYSTEM

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Abstract

Technological advancement with the rapid growth of population has brought a high impact on society's livelihood. Due to that, the consumption pattern has increased, and on the other hand, waste generation has been rise unconditionally that ultimately leads to garbage waste problems like overflowing. It gives challenges to waste monitors due to a lack of information about trash bins and its periodic collection of waste. So, to solve those issues, the Internet-of-things can be implemented. The garbage monitoring system, which is implemented using the Internet of things and provides real-time sensor information to authorized personals and dynamically, a dustbin will be empty on time. Garbage Monitoring systems that use the Internet of things are mainly to overcome contemporary systems, reducing energy consumption and maximizing operations by providing real-time information about trash bins to concerned people.

Key Words: *Arduino UNO; Garbage Monitoring System; Ultrasonic Sensor; Controller; Internet-of-Things*

1. INTRODUCTION

Due to the rapid modernization and population growth every year, there is always an exponential increment of waste generation pattern. Over the past few years, more than 1.3 billion tons of waste had generated in 2012, and by 2050 it would increase to 2.2 billion tons (Slame Kristanto, Takeshi Yashiro, Noboru Koshizuka, 2016). It would be highly challenging to the world, and with good foreshadowing from some researchers, and people forced to realize some tactics to solve issues efficiently. In our country Bhutan, municipal corporations have the sole responsibility to take care of garbage waste. Though the city takes good initiatives and duty to deal with such issues, however, due to the absence of real-time data and proper management framework, some of the problems remain unsolved by current waste management. Among those, garbage overflow is one of the main issues that occurred. So, to explain this issue in a better way, nations could receive the execution of Internet-of-Things based innovation. Such a proposed system can give real-time information about trash bins to concerned people, and dynamically trash can be collected when in need.

A survey of Smart environment conservation and protection

2. RELATED WORK

Smart bin: Smart Waste Management System.

This work proposes a smart bin system for proper waste monitoring and, it utilizes duty cycle methods for less power utilization and operational time. Shrewd container framework is conveying on an open-air test-bed, and use the data collected for six months to make bin addition and to relocate bins to another place. Sensor information will be pass with Wi-Fi, Ethernet, or 3G. (F Folianto, Y Sheng Low, Wai L Yeow, 2015).

IoT based Smart Garbage Monitoring and collection system

The objective of the thesis is to present the idea of a city with smart waste management effectively. The system employs the WeMos D1 mini, which has a built-in Wi-Fi module connected to each of the ultrasonic sensors. The thesis mentioned Pakistan with a 70% budget of garbage management goes to transportation and collection of trash. Therefore, to reduce that consumption, they use IOT technology to solve it in a better way. (S.K.Memon, F.K.Shaikh, N.A.Mahoto, A.Aziz, 2019).

This particular thesis emphasizes the maintenance of the green environment by providing real-time information about the status of each bin to the

authorized person. Here GSM modem with power supply is used to send notification from the sensors to the concerned person. Used the Route algorithm to find the shortest ways for drivers to arrive at the dustbin location. (E. Ramya, Dr.R.Sasikumar, 2017).

Smart waste management using IoT

The system mainly uses a geographic information system (GIS) and optimization algorithm. Used four algorithms. 1. Optimize routes to locate and empty identified waste bins, 2. Minimize the distance between two locations where the waste bin needs to collect, 3. Trash level in the waste bin, 4. Predict the waste produced for the coming days. This proposed system was simulated for the city in Pune with open data. This simulation has done to compare the efficiency of different ways of collecting wastes. (Gopal Krishna Shyam, Sunikumar S. Manvi, Priyanka Bharti, 2017)

IoT based garbage management (monitor and acknowledgment) system

The Paper mentioned that waste management is an absolute problem and keeping the garbage bin overloaded for more than a week. It is because the waste is not collected periodically, and many management bodies do not know the status of the dustbins. Due to such overflow, it makes the surrounding dirty, and many animals take the waste away from the bins, and it also spreads contagious diseases. With this proposal, it can notify the authorities about the status of the dustbins using IoT with real-time database access. (Sudharani Ashok Ghadage, Neeta Anilkumar Doshi, ICISS 2017)

3. BLOCK DIAGRAM & COMPONENTS

I. System Block Diagram

In the block diagram in the *figure 1*, we can figure out that the container is a place where we dump our waste, which we design with smart features like ability to show the bin level with color and send the bin level data to the server through GSM. And at the web app we receive those data and process accordingly and show the status of the bin. In the last part of the block diagram we send those information from the web app to mobile for the necessary actions after the bins get filled.

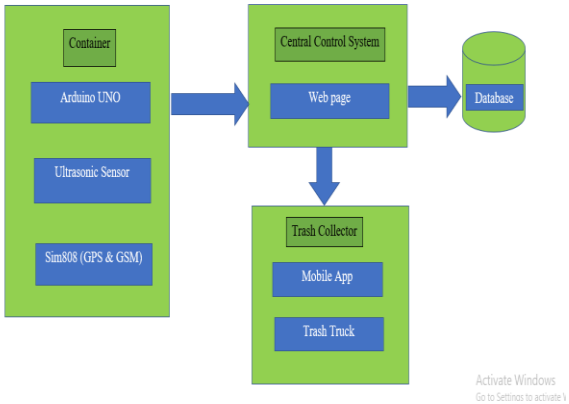

Figure 1 System Block Diagram

II. Ultrasonic Sensor

Used an ultrasonic sensor for measuring the distance of an object using ultrasonic waves. The sensor consists of a transmitter and receiver with four pins, Vcc, Trigger, Echo, and Ground. The working formula: Distance (d) = Speed (v) * Time (t). The transmitter transmits an ultrasonic wave, and then a reflected wave is received by the receiver. Connect a power supply of 5V from Arduino UNO through the Vcc Ground pins.

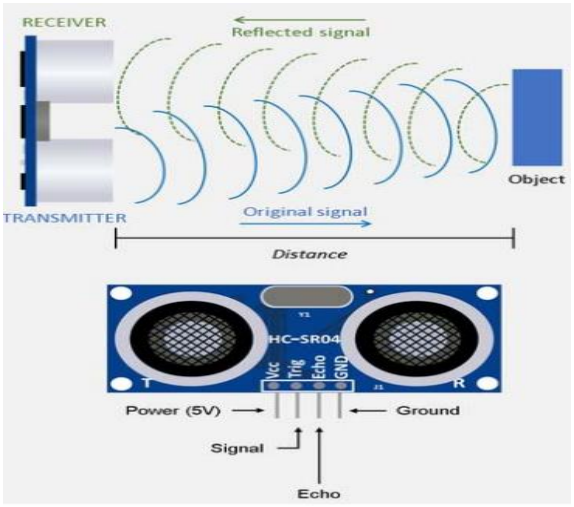

Figure 2 Ultrasonic Sensor

III. GSM SIM808

IM808 is a complete Quad-Band GPRS along with GPS technology for location tracking, which acts as a two-in-one function module. In a GPRS system, insert a 2G SIM card with the module is controlled by an AT command with voltage input 3.4V~4.4V, UART interface, and power supply button. Practically, the power supply of 9V~15V is needed to initialize the SIM808 module.

Figure 3 GSM SIM808 Module

IV. Arduino UNO

The Arduino UNO board is a micro-controller, and it has 14 (0 to 13) digital I/O pins, six analog pins (A0 to A5). The programmed logic will upload on this board through a USB cable connected to the computer.

Figure 4 Arduino UNO

*V. LED (*Light Emitting Diode*)*

LED: It is a semiconductor light source with the similar characteristics of PN junction diodes. LED is connected with the Arduino, and LED allows the current to flow in the forward direction, but it obstructs the reverse direction. Three LEDs are used in the system to indicate the fill level of the trash bin where green light glows when the trash bin is empty, yellow light glows when the trash bin is partially full, and the red one glows when it is ready to make unfilled.

4. METHODS

The proposed system will achieve by following the rooted methodology of the project team. For the cost-efficient selection of hardware components, we did a thorough paper review so that team can make a proper selection of hardware.

Hardware Design Methodology

A team can follow the designed project methodology to get useful products at the end of the project duration. If the project had done at a minimal cost, then the identification of designated components is essential at the earliest. The depicted methodology will guide the project team to build a good design of hardware with the test and debug procedure to produce quality prototype models. After we have procured specified hardware's, then we need to design hardware with proteus design suite software. Testing of hardware's should be done individually, so that each components works perfectly. When we are done with the coding phase, that error free code should be uploaded to the Arduino UNO board.

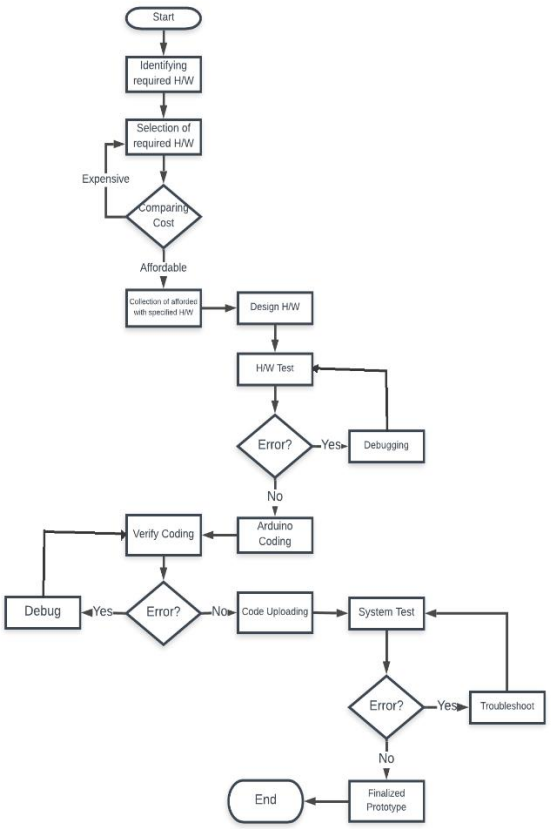

Figure 5 Hardware Design Methodology

Each phase is to accomplish by following the projected methodology, and after circuit design, we did software-developmental works accordingly.

Simultaneously, the team must be aware of the current waste management system and its weaknesses to make the livelihood of people in the society. For unit testing and integration testing, we have done as per the requirements of the projected methodology to have the desired outcome at the end.

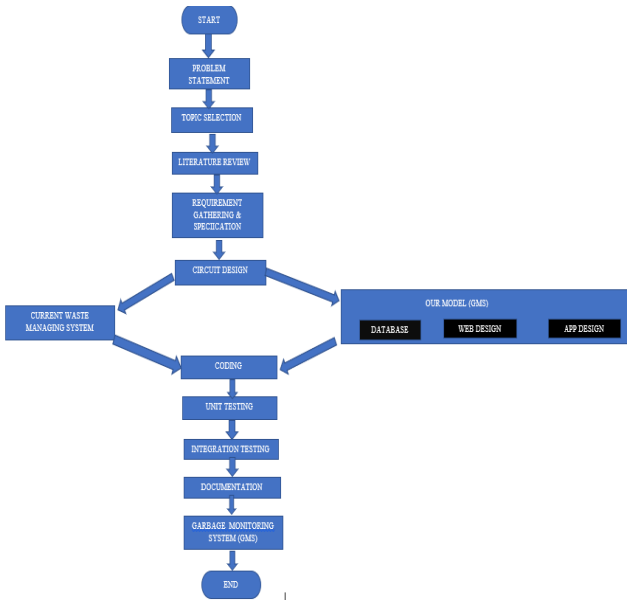

Figure 6 Projected Methodology

5. Result and Discussion

The section below is overall integration with the above-listed components and a simple design to fix ultrasonic sensors and GSM Module SIM808. Below *figure 7* shows the base of the trash bin and how they are integrated. GSM modules are placed at the base of the trash bin.

Figure 7 Component Integration

The *figure 8* shows how our smart trash bin looks like with the integrated hardware components. Pressed the button to initialize the GSM network, and sensor data sent to the database. Distance measuring ultrasonic sensor placed at the lid of a trash bin as the figure shows.

Figure 8 Smart trash bin

Sensor data will store in the database, and it can also be represented on the homepage of an application to show the status of trash bins. *Figure 9* is the view of the web application at the controller side.

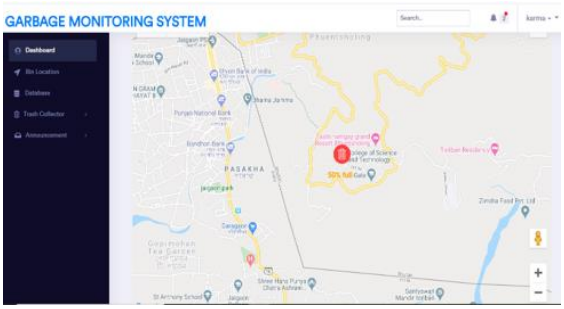

Figure 9 Web Application

The mobile application is provided for the trash collector to view the fill level of the trash bin after fetching data from the server. *The figure 10* depicts the view of mobile application on trash collector side.

Figure 10 Mobile Application

6. CONCLUSION

Improving technology in the country leads to the betterment of our country, and Internet services are available in every Dzongkhag in the country. The proposed system is to monitor garbage waste in the most populated cities. With this system, it can send real-time information about trash bins to concerned people, and hence it reduces the overflow of trash bins. Sensor data will be sent to the system database using GSM along with the location. On the web system, the status of the trash bin and position will be shown on the web to ease the concerned person to monitor. Trash collectors were notified through a mobile application so that trash bins can be empty on time. The sole purpose of such a system is to reduce energy consumption and to maximize operations through the use of IoT. Eventually, the prototyped model can contribute to those researchers to weigh modern systems and modern technology.

7. REFERENCE

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