



Internet of Thing (IoT) Garbage Monitoring System

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Abstract

Recent studies have shown that the total volume of waste generated globally is expected to increase by nearly 50% over the next decade; the adoption of innovative technologies will result in more integrated waste management solutions that move beyond the traditional use of labor, and waste disposal trucks (R. Akhil Nair, Valarmathie .P, 2019, pp 76-80). This paper, Internet of Thing (IoT) Garbage Monitoring system creates a very innovative system which will help to keep cities clean. The system monitors the garbage bins and informs about the level of garbage collected in the garbage bins via a web page. For this, the system uses ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth.

Keywords: *IoT, Garbage, Internet, Website, Sensor, LED.*

Introduction

Recent studies have shown that the total volume of waste generated globally is expected to increase by nearly 50% over the next decade; the adoption of innovative technologies will result in more integrated waste management

solutions that move beyond the traditional use of labor, and waste disposal trucks. Garbage according to the oxford dictionary can be defined as rubbish or waste, especially domestic refuse, worthless or meaningless

materials, it may also refer to unwanted material left over from City, Public area, Society, College, home, etc. The increasing accumulation of garbage or waste generated is a hazard especially when it is not properly taken care of on time or when even neglected. For growing cities that are endeavoring to be free of environmental pollution, cleanliness is paramount and cleanliness begins with making Garbage Bins available for proper waste disposal as well as the timely and proper final disposal of the contents of the Garbage bins to the final destination which is outside the vicinity of the city or a place properly designated for the final disposal of the garbage. (R. Akhil Nair, Valarmathie .P, 2019, pp 76-80).

This paper proposed an innovative system which will help to keep cities clean by implementing a system that would monitor and enable automated communications between the garbage bins and the garbage collection truck driver via an organized web based system depending on the state (or level) of the garbage. All this is in a bid to keep the city clean and hygienic as already emphasized.

STATEMENT OF THE PROBLEM

The more cities experience development and growth, the more the level of garbage generation increases due to people increased activities especially in industrialized states, commercial cities, as well as increase in number of buildings and residential houses. This development would increase the number of garbage and thus the garbage bins, the distance to the location and number of these garbage bins would be increased as well. If nothing is done to the manual default process of garbage bin checking, garbage collection and disposal, many garbage bins would either be filled up or over filled without being attended to.

AIM AND OBJECTIVES

This paper is aimed to design a system based on arduino microcontroller working with the ultrasonic sensor that detects the level of waste in the garbage bin from an area and constantly at regular interval display the statuses as filled, half-filled, or empty on an LCD screen, as well as send the content level information at those intervals to a central system that displays the garbage bin level graphically. The objectives of this work will include:

1. Identification of garbage bins to know its location and increase efficiency to empty it.
2. Continuous monitoring of the garbage bin level (this will be achieved using an ultrasonic sensor).
3. Enable the garbage bin to send data to a web application via a Wifi modem
4. Make the OLED screen to display the status of the garbage to the user.
5. To provide a web interface to graphically display the level of the garbage bin. This would help determine if the garbage bin contents is due for collation.

METHODOLOGY

Numerous technique or discoveries from this field primarily created into diary for others to take favorable circumstances and enhance upcoming investigations. The

strategy is use to achieve the objective of the paper that will accomplish a perfect result. With a specific end goal to assess this project, the procedure is based on System Development Life Cycle (SDLC), generally three major step, which is planning, implementing and analysis. For this particular section we would be dealing with only the Planning, Analysis and Design stage

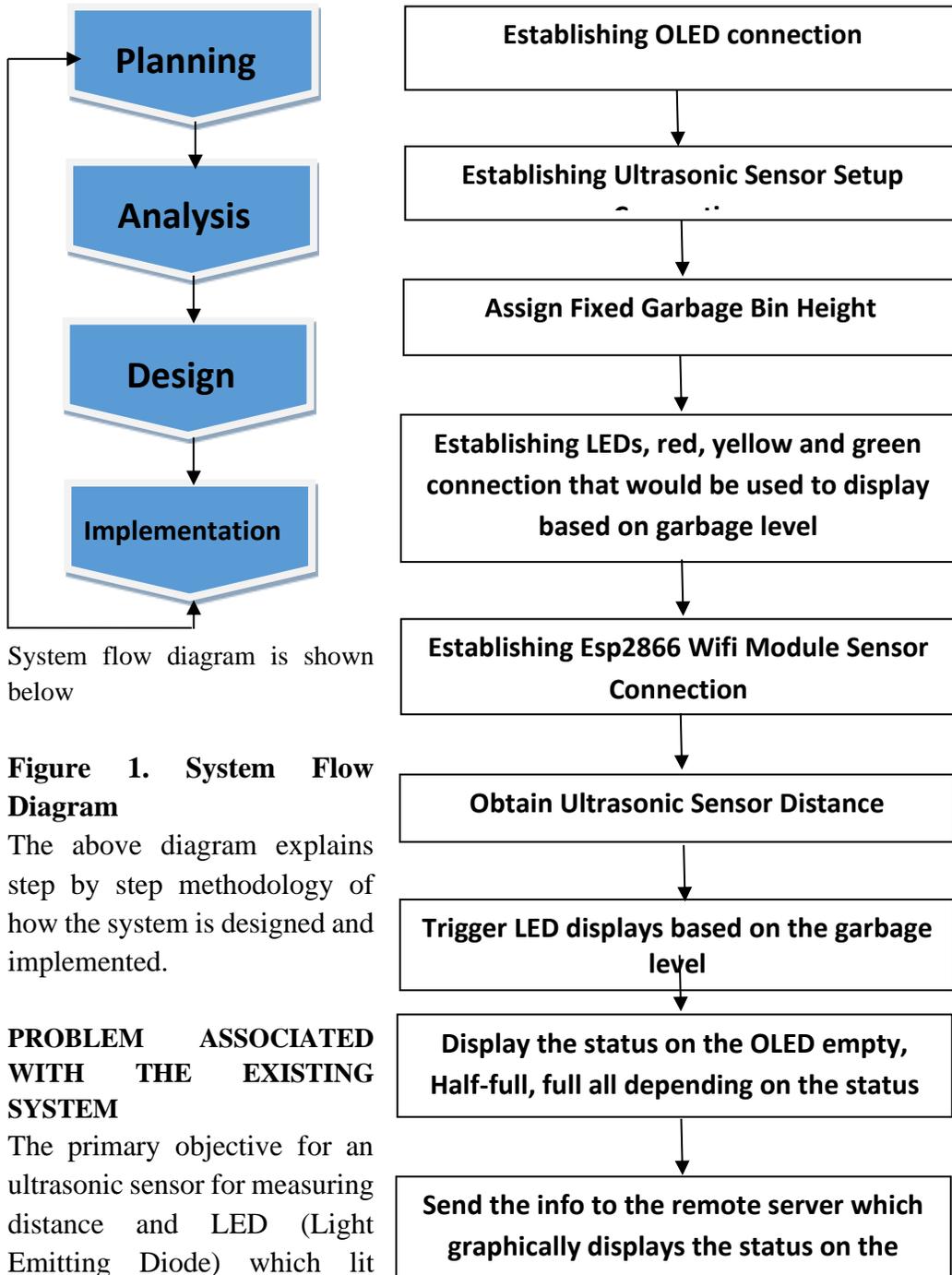


Figure 1. System Flow Diagram

The above diagram explains step by step methodology of how the system is designed and implemented.

PROBLEM ASSOCIATED WITH THE EXISTING SYSTEM

The primary objective for an ultrasonic sensor for measuring distance and LED (Light Emitting Diode) which lit

always and LCD (Liquid Crystal Display) which displays the status is for a user to know when it's getting filled in a fixed location which is good but to monitor it from afar distance, to manage or get notified without physically being there is a limit which would not always help mitigate future miss-guesses. The problem associated with the existing system is that no central location is provided to serve as medium between the user and the sensors as their readings are stored to enable the user to track any analysis on the read data.

For every system, there are three things involved: input, process and output; after the three have been completed, results should be stored in a location either internal or external memory all working together to have and track the proper record of what was measured for future use and reference. The existing system has no provision for a central system to track the garbage level or status to meet the well-intended purpose of being aware of what is currently on.

This proposed research work will see to the associated problems and make necessary correction to improve the workability of the proposed system. In every system there comes a time the system gets weak to serve the full purpose which it was developed to accomplish. There is, therefore, the need for integration and modification so as to achieve the desired purpose of the user, which gave rise to this research work.

PROPOSED SYSTEM AND MODELING

This proposed system is simulated in an environment called Proteus 8.5 professional and Nodemcu is the development board while the software is C Programming Language with libraries that come with unique development software also called the Nodemcu IDE. Proteus 8.5 is a highly performance Software for simulating technical computing. It integrates computation, displays how the constructed system that is designed would work. Nodemcu Uno as the development board provides a simple friendly and easy-to-use environment where problems and solutions are expressed in familiar mathematical notation, which at the end of the day will filter the workability of the hardware components. The programming language favorable to drive the circuit or devices to be at their optimum performance, C programming language was the choice, it has less than 1% failure rate when developed to interact with hardware components. This Proteus 8.5 is an environment for multi-domain simulation and Model-Based Design for dynamic and embedded systems. It provides interactive graphical environment and a customizable set of block libraries that facilitates the design, simulation, implementation, and testing a variety of time-varying systems, including communications, controls, signal processing, real time clock control, storage and wireless sensors processing. In order to demonstrate the concepts of the suggested simulation methodology, a simple smart garbage monitoring system model was built as shown in figure below. This IoT system consists of an ultrasonic sensor that

captures the data and then sends it to the central server via the controller where it is stored and LED as well as the LCD displays the status of the garbage, while the LED turns on depending on the level of the status.

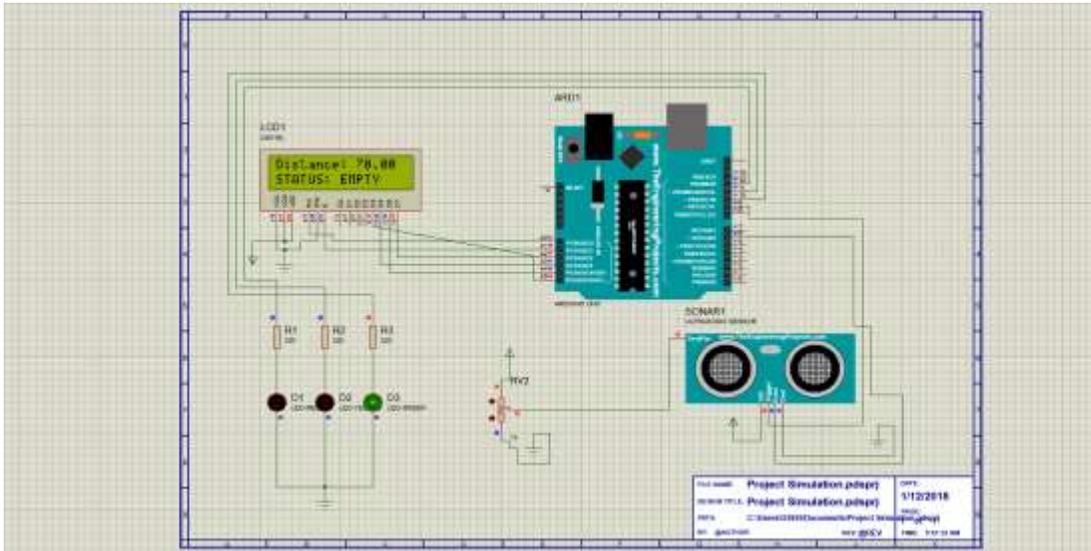


Figure 2: System Simulation

SYSTEM DESIGN:

The smart garbage monitoring system consists of one input and two outputs. All electronics operation is controlled by a single microcontroller unit, which is programmed based on how other peripherals will behave. This device, consists of Arduino uno Board, 1 ultrasonic sensor; wifi module, (Liquid Crystal Display) OLED, and LED (Light Emitting Diode). Ultrasonic sensor is used to detect the distance in the garbage bin. All of the sensor data reading will register into the microcontroller unit. The data will be displayed on the OLED and also sent to the remote server via the wifi module which would store the information in the database so that the web application or central system can display it via the web page so it can be viewed remotely where it can be monitored. Hence the garbage status or level information is accessible to the user through the capabilities of electronic gadgets such as laptop, desktop and smartphone. The data collected by the sensors will be uploaded into data log file and these data will be updated using any of the electrical gadgets and displayed for viewing. The data on the webpage will be updated every 5 minutes. Figure 3 shows system design architecture.

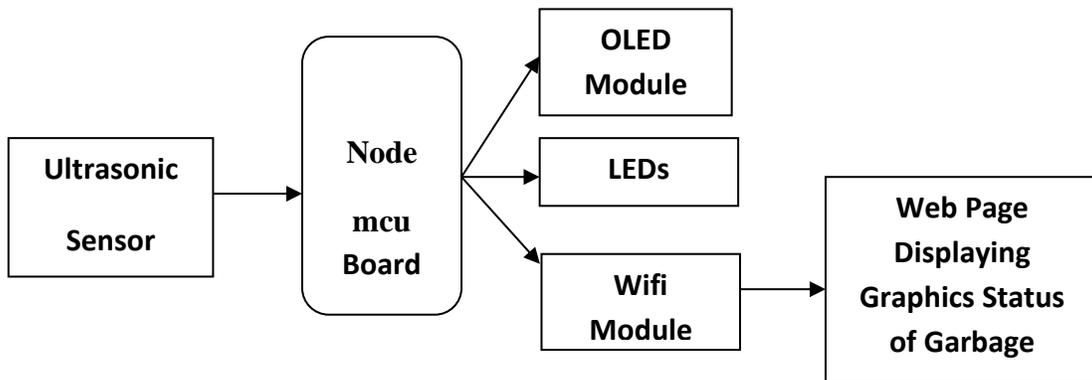


Figure. 3: System Design Architecture

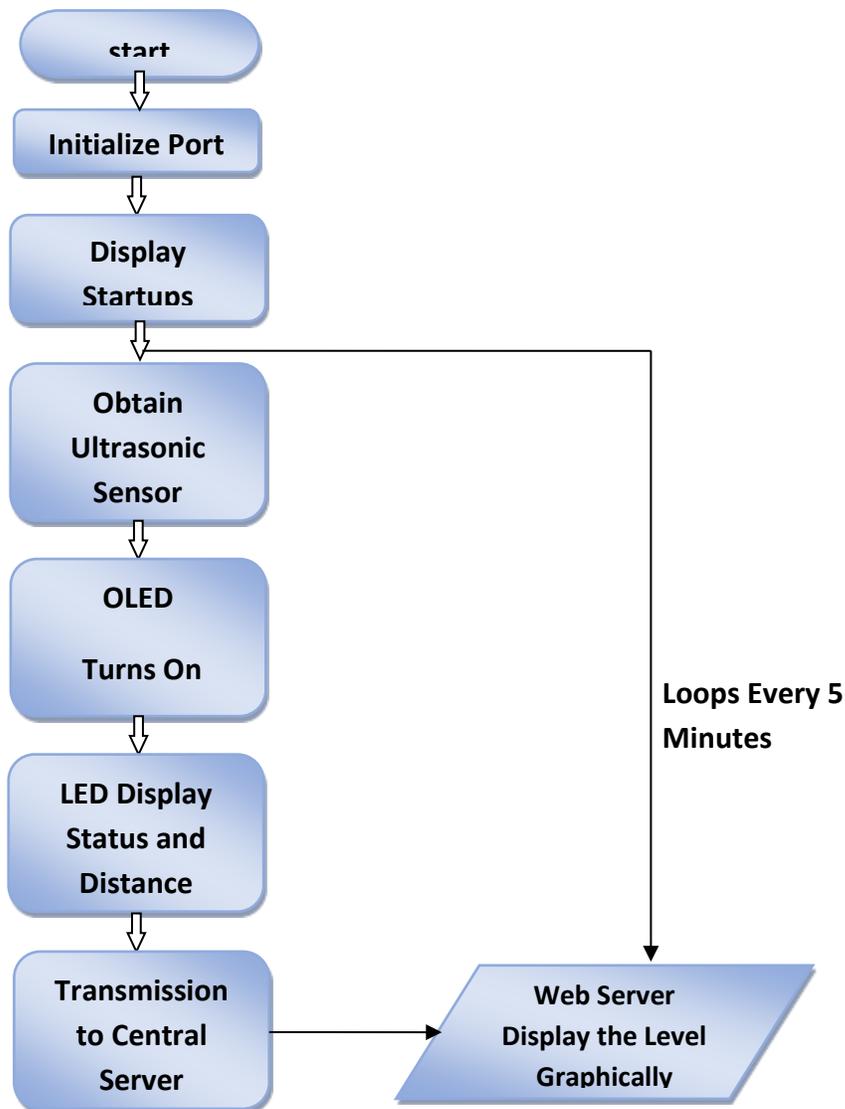


Figure 4: System Flowchart

RESULTS

The results obtained in this paper are the outputs gotten from the sensors reading, stored in the garbage-iot.herokuapp.com site. Several running and testing had been performed to evaluate the device workability in real situation. For the results, the distance measurement of the garbage bin are sent to the website <https://garbage-iot.herokuapp.com/> which displays a bar chart showing the level of the garbage with any desired location that has been specified which is just optional. It can be seen in figures below.



Figure 12: Image Showing that the garbage is due for collection, as space left is 20 and the distance almost filled up.

Figure 13: Images below are showing that the garbage is due for collection, when the space left as 20 and 45 respectively the distance almost filled up





DATA LOGGING

The ultrasonic module sends data to <https://garbage-iot.herokuapp.com/> through the wifi module and is access via phone or personal computer. There data logging of the different status or levels of the garbage bin with the date and time is shown in graphical on a bar chart.

DISCUSSION OF RESULT

It is very important to have the parameter namely height or distance values to track the level of the garbage to be aware of the current level of the garbage. This would ensure that the values shown in the central system is real and can be relied upon to effectively manage the garbage used in the increasingly populated cities and thus help keep the cities clean in an increasing efficient way. This will ensure enormous advances in technology most especially in this present age where there is serious improvement in creativity and in using technology to better the lives of city dwellers and the environment of course. The outcome of the parameter such as when the garbage bin is half filled, empty or almost filled be deliberated in the order in as shown in the figure above, the red led illuminates and the web page displays the bar chart with a red color when the garbage bin is almost filled, the yellow led illuminates and the web page displays the barchart with red color when the garbage is half-way filled, and the green led illuminates and the garbage displays the bar chart with green color when the garbage is almost empty if not empty.

CONCLUSION

The idea of this system is to enable mass monitoring of environmental condition by strategically focusing on the rate at which garbage bins are filled and help prevent overflow which in most cases leads to environmental degradation. Most often it is said that the little things in life almost always becomes the big things, and it applies in this case to environmental living conditions and standard of living. This little negligence if not curtailed could lead to increased environmental degradation and that is what this paper is designed to solve, which aims to smartly monitor and manage garbage in the increasing populated towns and cities. With time users would acknowledge the fact that this results in their environmental conditions being even more safer and cleaner as no one needs to be reminded of what needs to be done about the seemingly little things that if not considered could cause big negative impact.

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