WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Smart Sensor Based Automatic Dustbin Notification System using IOT

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ABSTRACT

This project proposes a smart alert system for garbage clearance by giving an alert signal to the municipal supervisor for instant cleaning of dustbin with proper verification based on level of garbage filling. This process is aided by the ultrasonic sensor which is interfaced with NodeMCU microcontroller to check the level of garbage filled in the dustbin and sends the alert to the municipal server once if garbage is filled. After cleaning the dustbin, the smart garbage alert system by providing automatic identification of garbage filled in the dustbin and sends the status of clean-up to the server affirming that the work is done. The whole process is upheld by an embedded module integrated with GSM module.

I. INTRODUCTION

Health and safety has always been top priority despite the increasing technology and human race. Though the causes and effects of sewage gases are high, there is growing demand for effective monitoring and alerting system. Without a proper sewage management system, our society can be exposed to extensive damage to our lives. Some of the areas to be concerned based on top of economic, social aspects for maintaining sustainability in the sewerage design are the requirements of energy and control of door. The stability of such infrastructure is getting affected for many decades in India which has given the unaccountable effects on human and economic costs related for the infrastructural improvement of the projects. This sewerage system is therefore in need for the availability of cheap and less valued workers of low caste people. This system of sewerage has worsened the physical vulnerability and poor health of sewerage labours significantly.

The waste management services take care of a healthy environment allowing optimization of the utilities and prevent overloading the carrier for waste disposal. Smart waste management also contributes to the overall waste recycling efficiency and provides the route optimization opportunity for utilities to reduce traffic and fuel use.

CURRENT SOLUTIONS

The solutions available on the market suffer from two major disadvantages. The first is related to the usage of the ultrasonic sensor. Trash is nonuniformly distributed inside the container. Simple distance measurement leads to false fill level measurement. Although several software procedures were proposed to increase the accuracy of this sensor, unfortunately, results remain poor. By using multiple sensors, the fill level can be determined more precisely, however, the cost of the system also increases. So, this is usually not a commercially preferred solution.

The second of the current solution is that it is partial and incomplete. The waste management cycle starts with the garbage being produced, then it gets disposed at the local trash bins or other garbage collection points. Afterward, it is being collected by a garbage collecting company and brought to garbage depot where it is being sorted and sent for recycling, destruction (burning), or storage. Complete waste management should be involved in trash bin fill level measurement, route optimization of the trucks, and contribution to the recycling process by easing out the sorting process, which is currently manual and slow. Current smart waste management services do not offer any solution with regard to the recycling process.

INTERNET OF THINGS (IoT)

Today, Internet application development demand is very high. So IoT is a major technology by which we can produce various useful internet applications. Basically, IoT is a network in which all physical objects are connected to the internet through network devices or routers and exchange data. IoT allows objects to be controlled remotely across existing network infrastructure. IoT is a very good and intelligent technique which reduces human effort as well as easy access to physical devices. This technique also has autonomous control feature by which any device can control without any human interaction.

PROPOSED IMPROVEMENT

Recycling trash is a complex task. Obstacles that may be encountered in the implementation of this task are as follows;

- recyclables are distributed throughout the city (municipality) and collection of recyclables and other materials is complicated;
- the city trash and recyclable materials are generated not only in every home, building and production facilities but also in public spaces (streets, parks);
- each recyclable has a different strategy for the end of life management.

Recycling of used products could be simpler and cheaper through the establishment of a system for automated management of product lifecycle, whereby, the technical information about the product must be incorporated in itself during production. Information such as the materials of which the product is made, ways to recycle, repair, or installation of its elements must be contained in the product itself. Thus, organizations responsible for waste collection could automatically search for the contents of the container or special items and organize collection service according to this information. Should this happen, there would be a huge reduction in the quantity of municipal solid waste, which would make waste management activities become cost-effective for both the city and citizens.

II. LITERATURE SURVEY

F. Ingelrest. al.,(2017) Sensor Scope is a turnkey solution for environmental monitoring systems, based on a wireless sensor network and resulting from a collaboration between environmental and network researchers.

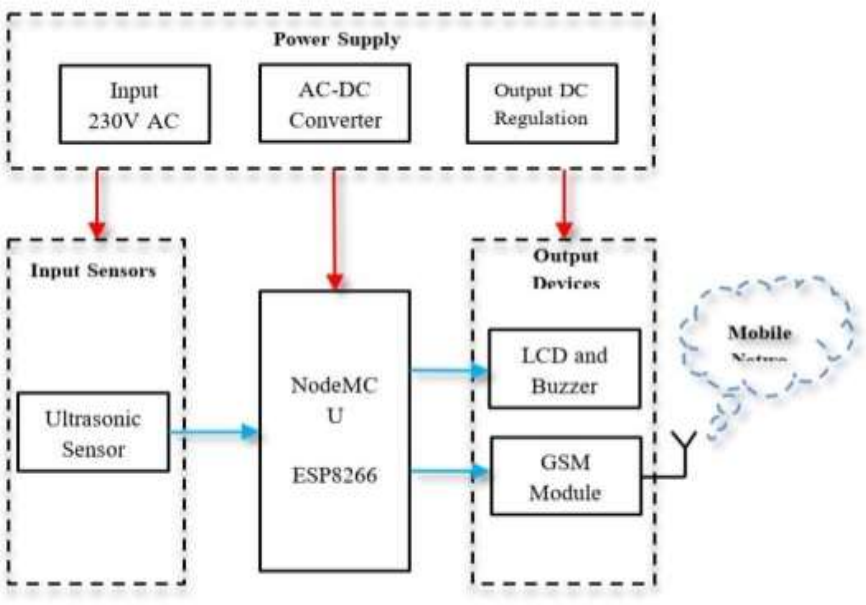
W. Lu, N. B. Chang. al.,(2010) this paper provides a thorough literature review of current state-of-the-art systems analysis techniques for urban solid waste collection and identifies four intrinsic deficiencies of the existing studies over different types of cities.

T. Anagnostopoulos. al.,(2017) The new era of Web and Internet of Things (IoT) paradigm is being enabled by the proliferation of various devices like RFIDs, sensors, and actuators.

III. PREVIOUS WORK

Manual systems in which employees clear the dumpsters periodically. No systematic approach towards clearing the dumpsters. Unclear about the status of a particular location. Employees are unaware of the need for a particular location. Very less effective in cleaning city. No systematic approach towards clearing the dumpsters.

ARCHITECTURE



IV. PROPOSED WORK

This project offers a solution to this issue by having separated waste compartments account for different types of waste, such as plastic and general waste. In order to effectively identify and segregate different types of waste, an object detection model is trained using a tensor flow framework and exported to a Python Language to perform waste detection. Ultrasonic sensor monitors the filling level of the bin, while a GPS module monitors its location. The status of the bin's filling level and location is then sent to the server through an IoT module for the purpose of monitoring.

V. ALGOITHMS USED

Hardware Specification

- NodeMCU
- Ultrasonic Sensor
- LCD Display
- GSM
- Power Supply +5V and +12V Software Specification
- Operating System : Windows OS 10
- IDE : Arduino

IDE 1.8.13

The gas levels are sensed through the respective sensors (here HC SR04) and sent to the NodeMCU. The sensed analog signals are converted to digital through ADC. The sensed bin levels are displayed in LCD; if any one gas level exceeds the set point then an alarm is generated immediately. At the same time an alert message is sent to the authorized user through the WiFi.

The Smart Bin system, at the beginning the NodeMCU start the connection with the charity organization website server and check the status of the box if the load cell sensor is cut and the high level are cut also that means the box is full; in this case, the system will update the status of the donors to full. Otherwise, if only the low level is cut the smart bin box status will update it not full and connection with the server.

Power Supply

This circuit is a small +5V power supply, which is useful when experimenting with digital electronics. Small inexpensive wall transformers with variable output voltage are available from any electronics shop and supermarket. Those transformers are easily available, but usually their voltage regulation is very poor, which makes then not very usable for digital circuit experimenter unless a better regulation can be achieved in some way. The following circuit is the answer to the problem.

Transformer

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled wires. A changing current in the first circuit (the primary) creates a changing magnetic field; in turn, this magnetic field induces a changing voltage in the second circuit (the secondary). By adding a load to the secondary circuit, one can make current flow in the transformer, thus transferring energy from one circuit to the other. The secondary induced voltage V_S is scaled from the primary V_P by a factor ideally equal to the ratio of the number of turns of wire in their respective windings:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up — by making N_S more than N_P or stepped down, by making it less.

Rectifier

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which flows in only one direction. The process is known as rectification. Rectifiers are used as components of power supplies and as detectors of radio signals. Mainly there are three types of rectifier i.e. half wave rectifier, full wave rectifier and Bridge Rectifier.

ESP-12E Module

The development board equips the ESP-12E module containing ESP8266 chip having Tensilica Xtensa® 32-bit LX106 RISC microprocessor which operates at 80 to 160 MHz adjustable clock frequency and supports RTOS.

Arduino Nano has similar functionalities as Arduino Duemilanove but with a different package. The Nano is inbuilt with the ATmega328P microcontroller, same as the Arduino UNO. The main difference between them is that the UNO board is presented in PDIP (Plastic Dual-In-line Package) form with 30 pins and Nano is available in TQFP (plastic quad flat pack) with 32 pins. The extra 2 pins of Arduino Nano serve for the ADC functionalities, while UNO has 6 ADC ports but Nano has 8 ADC ports. The Nano board doesn't have a DC power jack as other Arduino boards, but instead has a mini-USB port. This port is used for both programming and serial monitoring. The fascinating feature in Nano is that it will choose the strongest power source with its potential difference, and the power source selecting jumper is invalid.

ULTRASONIC SENSOR

The HC-SR04 ultrasonic sensor uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1" to 13 feet.

The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module.

Ultrasonic sensors work by emitting sound waves with a frequency that is too high for a human to hear. These sound waves travel through the air with the speed of sound, roughly 343 m/s.

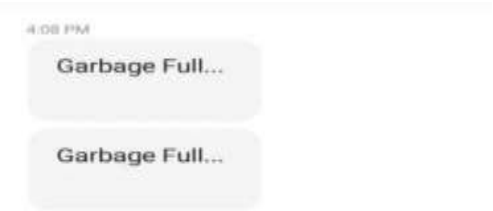
GSM

A GSM network consists of the following components: It is the mobile phone which consists of the transceiver, the display and the processor and is controlled by a SIM card operating over the network.

SOFTWARE DESIGN ARDUINO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

VI. EXPERIMENTAL RESULTS



VII. CONCLUSION

In this project the implementation of smart dustbin management system using GSM as a hardware and ionic framework as our software insures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in specific time, then the record is sent to the higher authority in our case the admin who can take appropriate action against the concerned employee. In our project we are only using a GSM that will notify the assigned employee regarding the value of the dustbin. But in the dustbins not only notify about their values but also share the predefined locations so that it becomes easy to find those dustbins and empty them.

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