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Smart Garbage Detection System Using Iot Through Mobile App

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Abstract- **Nowadays certain actions are taken to improve the level of cleanliness in the country. People are getting more active in doing all the things possible to clean their surroundings. The absence of efficient waste management has caused serious environmental problems and cost issues.Various movements are also started by the government to increase cleanliness. We will try to build a system which will notify the corporations to empty the bin on time. This model consists of an atmega328 controller, a few garbage bins loaded with ultrasonic sensors and they are monitored continuously through a mobile app. When the garbage will reach the maximum level, a notification will be sent to the operators, and then the employees can take further actions to empty the bin. This system will help in cleaning the city in a better way. By using this system people do not have to check all the systems Manually but they will get a notification when the bin will get filled.**

I. INTRODUCTION

IoT or Internet Things refers to the network of connected physical objects that can communicate and exchange data among themselves without the desideratum of any human intervention. It is defined as an "Infrastructure of Information Society" because IoT sanctions us to amass information from all kind of mediums such as humans, animals, conveyances, kitchen appliances. Thus, any object in the physical world which can be provided with an IP address to enable data transmission over a network can be made part of IoT system by embedding them with electronic hardware such as sensors, software and networking gear. IoT is different than Internet as in a way it transcends Internet connectivity by enabling everyday objects that utilizes embedded circuits to interact and communicate with each other utilizing the current Internet infrastructure . In this paper, we are going to propose a system for the immediate cleaning of the dustbins. As dustbin is considered as a basic need to maintain the level of cleanliness in the city, so it is very important to clean all the dustbins as soon as they get filled. We will use ultrasonic sensors for this system. The sensor will be placed on top of bin which will help in sending the information to the operator that the level of garbage has reached its maximum level. After this the bin should be emptied as soon as possible. The concept of IoT when used in this field will result in a better environment for the people to live in. No more unsanitary conditions will be formed in the city. With the help of this system minimal number of smart bins can be used around the whole city and the city will still be much cleaner. The proposed system will help in removing all these disadvantages. The real-time information can be gained regarding the level of the dustbin filled on the system itself. It will also help in reducing the cost as the employees will have to go only at that time when the bin is full. This will also help in resource optimization and if the bins will be emptied at Time then the environment will remain safe and free from all kinds of diseases. The cities will become more cleaner and the smells of the garbage will be much less.

II. LITERATURE REVIEW

A Smart Dustbin [1] based on IoT in which the smart bin was built on a platform which was based on Arduino Uno board which was interfaced with a GSM modem and an ultrasonic sensor. The sensor was placed on the top of the bin.

A threshold level was set as 10cm. As the garbage reaches the level of threshold, the sensor triggers the GSM modem which alerts the associated authority till the garbage in the bin is emptied. At the end a conclusion was made that various issues like affordability, maintenance and durability were addressed when these smart bins were designed. It also contributed towards a hygienic and clean environment in the process of building a smart city.

The researchers [2] suggest the method for garbage management which is as follows. The bin was interfaced with a system based on microcontroller which had IR wireless systems with a central system that showed the current status of the garbage in the bin. The status was seen on a mobile based web browser with an html page by using Wi-Fi. To reduce the cost, they only used weight based sensors and on the sender's side they only used a Wi-Fi module to send and receive the data. In the end the sensor could only detect the weight of waste present in the bin but not the level of waste. The author proposed a method for organizing the collection of the garbage in the commercial and residential areas of the cities.

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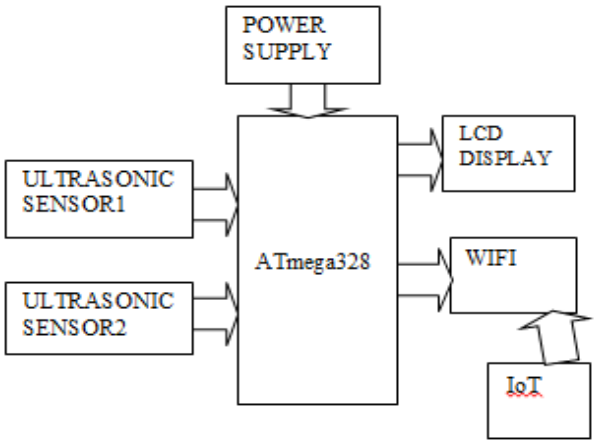
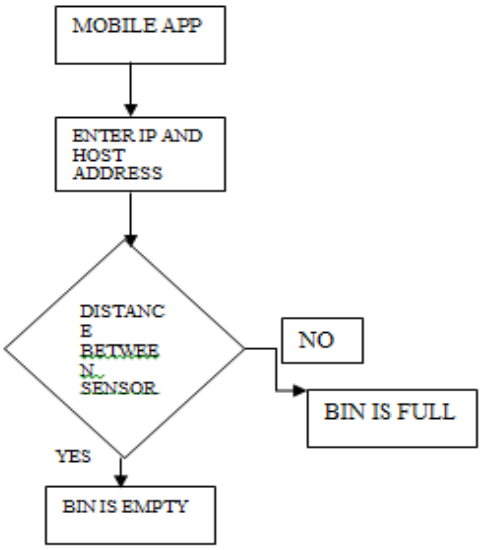
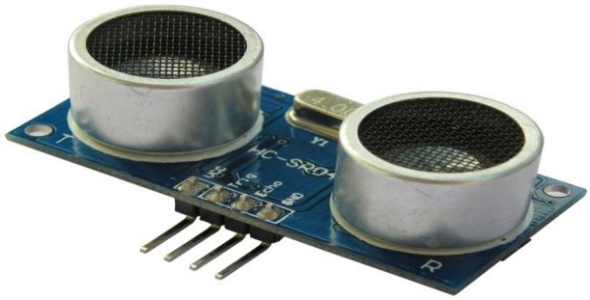
In this system, the level of garbage in the bin was detected by the ultrasonic sensor which will send the data to the operator using IoT through mobile app.

Block diagram





Ultrasonic sensors



the ultrasonic sensor is used to measure the distance with high accuracy and stable readings. it can measure distance from 2cm to 400cm or from 1 inch to 13 feet. it emits an ultrasound wave at the frequency of 40 khz in the air and if the object will come in its way then it will bounce back to the sensor. by using that time which it takes to strike the object and comes back, you can calculate the distance. distance can be measured by equation 1.

distance = time * sound speed /2. (1).

where time = the time between an ultrasonic wave is received and transmitted. it has four pins. two are vcc and gnd which will be connected to the 5v and the gnd of the arduino while the other two pins are trig and echo pins which will be connected to any digital pins of the arduino. the trig pin will send the signal and the echo pin will be used to receive the signal. to generate an ultrasound signal, you will have to make the trig pin high for about 10us which will send a 8 cycle sonic burst at the speed of sound and after striking the object, it will be received by the echo pin.

ARDUINO

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The micro controller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software running on a computer (e.g. Flash, Processing, and MaxMSP). Arduino is a popular open-source single-board micro controller, descendant of the open-source Wiring platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the board.

ATmega328

The ATmega48PA/88PA/168PA/328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega48PA/88PA/168PA/328P achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed.

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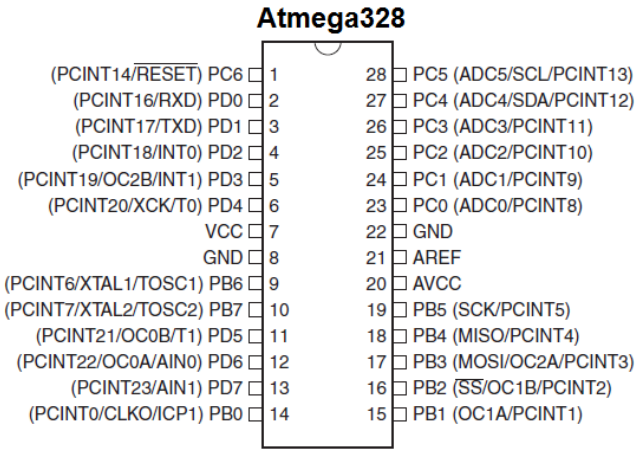


VCC
Digital supply voltage.

GND
Ground.

Port B (PB7:0) XTAL1/XTAL2/TOSC1/TOSC2
Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port C (PC5:0)
Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC5.0 output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

PC6/RESET
If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C.If the RSTDISBL Fuse is unprogrammed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running.

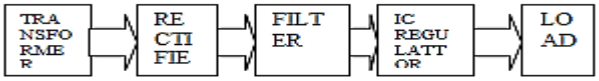
Port D (PD7:0)
Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

AVCC
AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that PC6...4 use digital supply voltage, VCC.

AREF
AREF is the analog reference pin for the A/D Converter.

ADC7:6 (TQFP and QFN/MLF Package Only)
In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

POWER SUPPLY
The AC voltage, typically 220V RMS, is connected to a transformer, which steps that AC voltage down to the level of the desired DC output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a DC voltage. This resulting DC voltage usually has some ripple or AC voltage variation. A regulator circuit removes the ripples and also remains the same DC value even if the input DC voltage varies, or the load connected to the output DC voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.



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TRANSFORMER

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using a precision rectifier are it will give a peak voltage output as DC, the rest of the circuits will give only RMS output.

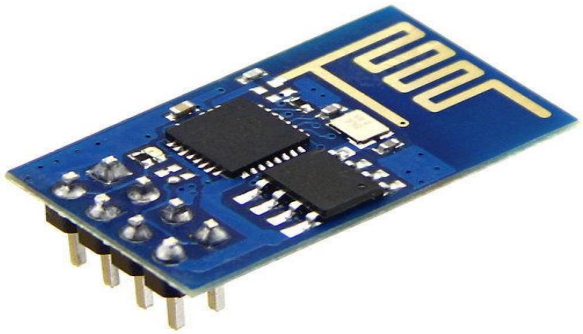
BRIDGE RECTIFIER

When four diodes are connected as shown in the figure, the circuit is called as a bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

IC VOLTAGE REGULATORS

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustable set voltage. The regulators can be selected for operation with load currents from hundreds of Mille amperes to tens of amperes, corresponding to power ratings from mill watts to tens of watts. A fixed three-terminal voltage regulator has an unregulated DC input voltage, VI, applied to one input terminal, a regulated DC output voltage, Vo, from a second terminal, with the third terminal connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

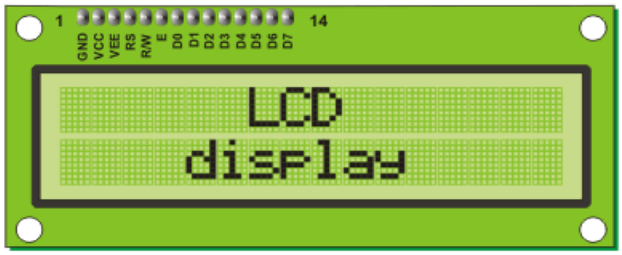
ESP8266 WIFI Module



The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your W-iFi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a Wife Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime.

LCD display

An LCD is a small low cost display. It is easy to interface With a micro-controller because of an embedded controller. This controller is standard across many displays, which means many micro-controllers have libraries that make displaying messages in a single line of code.



Features:

- ✓ 5 x 8 dots with cursor
- ✓ built-in controller
- ✓ + 5v power supply (also available for + 3v)
- ✓ 1/16 duty cycle
- ✓ b/l to be driven by pin 1, pin 2 or pin 15, pin 16 or a.k (led)
- ✓ n.v. optional for + 3v power supply

TCP TELNET

It works based on TCP/IP protocol, using this app we can create TCP client that communicate with server. To start a telnet terminal, you must provide ip address and port number of the server. After connection is established with server, you can easily access and communicate with your server.

WORKING

This model consists of an atmega328 controller, a few garbage bins loaded with ultrasonic sensors and they are monitored continuously through a mobile app. When the garbage will reach the maximum level, a notification will be sent to the operators, and then the employees can take further actions to empty the bin. The ultrasonic sensor will sense the level of bin by producing sound waves. we are fixing certain distance , if the distance between the bin and sensor is long means , the bin is empty.

if the distance between the bin and sensor is short means , the bin is full. When the garbage will reach the maximum level, a notification will be sent to the operators, and then the employees can take further actions to empty the bin.

ADVANTAGES

- System can be accessed anytime and from anywhere.
- Real-time data transmission and access.
- Avoids the overflow of garbage bins.
- Fuel saving.
- Time consuming is less.

APPLICATION

- Waste Level detection inside the garbage bins.
- Municipal authorities or other private firms to tackle the current problem of urban waste collection.
- Industries.
- Marketing areas.

III. CONCLUSION

This implementation of smart garbage collection system using IoT, assures 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 who can take appropriate action against the concerned official. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduces the total number of trips of garbage collection vehicle and hence reduces the overall expenditure associated with the garbage collection. It is ultimately helps to keep cleanliness in the society. This is quite a significant project in its originality and concept. We are using internet of things theory which gives this project its charisma and uniqueness about the concept. The project aims at cleanliness of the areas where trash bins are located and the very basic management that it contains with it. It aims at advanced management of the whole garbage collection system. We use ultrasonic sensors (details mentioned above) and its other hardware microcontrollers and processors such as Arduino and ATmega328 for analyzing the garbage levels and sending information about it to administrators and then garbage trucks are being deployed by them. another very important aspect of our project is the Mobile app that is designed in such a way that operators will find it user friendly to monitor the garbage information of various places (as discussed above). Hence, all in all, an IoT concept based software project with electronic devices used, is the one that will be a great service to the world and make it a better place to live in, to some extent.

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