International Journal of Engineering Sciences &Research Technology

(A Peer Reviewed Online Journal)
Impact Factor: 5.164

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[NACETEC' 19]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

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INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

SMART WASTE MANAGEMENT USING IoT

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DOI: 10.5281/zenodo.2631629

ABSTRACT

A system is introduced to reduce waste in cities effectively without monitoring the parts 24x7 manually. The problem of non-systematic and unorganized waste collection is resolved by introducing an embedded IoT system which can monitor each dumpster individually on the basis of amount of waste deposited in it. An automated system is provided for separating wet and dry waste in to two according to their properties. A mechanical based setup is used for segregating wet and dry waste into separate containers by using sensors. The presence of any wet waste or dry waste are detected using an IR sensor and moister sensor. Here, if only IR is detected motor will rotate in the corresponding direction of the dry waste container while both the sensors detects then it will rotate to the corresponding direction of the wet container.The containers are consolated to an ultrasonic sensors embeded at the top, which is used detect the amount of waste in the containers. Whenever any one of the containers is full then an alert message will be sent to the corresponding personal android application.

KEYWORDS: ARDUINO, ANDROID APPLICATION,IoT

1. INTRODUCTION

A common problem that the big cities around the world are facing is managing the city waste effectively without making city unclean. Today's waste management systems consists of a large number of employees to attend a large number of dumpsters that is done every day periodically. This leads to a unclean system and very inefficient in which some dumpsters will be overflowing and some dumpsters might not be even half full. This is due to the variation in population density in the city or some other random factor this makes it impossible to determine which part needs immediate attention. In this waste management system, each dumpster is embedded in a monitoring system which will notify the corresponding personal if the dumpster is full. Here the waste management system is also capable of separating wet and dry waste into two distinct containers. This system provides an effective solution to waste management problem.

2. MATERIALS AND METHODS

HARDWARE REQUIREMENTS

ARDUINO MEGA:
The Arduino Mega is a microcontroller board based on the ATme theATmega1280 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

ULTRASONIC SENSORS:
As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves.
The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

IR SENSOR:

ISSN: 2277-9655
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An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion.These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor.

MOISTURE SENSOR:
The Moisture sensor is used to measure the water content(moisture) of soil.when the soil is having water shortage,the module output is at high level, else the output is at low level.This sensor reminds the user to water their plants and also monitors the moisture content of soil.It has been widely used in agriculture,land irrigation and botanical gardening.

DC MOTOR:
A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

ESP8266:
The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Espressif Systems[1] in Shanghai, China. The chip first came to the attention of western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands.

PIV:
Particle Image Velocimetry (PIV) is a non-intrusive laser optical measurement technique for research and diagnostics into flow, turbulence, microfluidics, spray atomization and combustion processes. Standard PIV measures two velocity components in a plane (2D2C) using a single CCD or CMOS camera.

Wi-Fi Module:
Major part of this system depends upon the working of the Wi-Fi module. Wi-Fi Module helps us to send the details of the dustbin at the receiver side. The controller gives the details to the transmitter module (Wi-Fi module). At the receiver section a mobile handset is needed to be connected to the Wi-Fi router so the details of the garbage bin is displayed on the web page and a mail notification (like email) will be sent to the respective Municipal / Government authority person.

SOFTWARE REQUIREMENTS

Arduino IDE:
*The **Arduino integrated development environment (IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.*

Android API:
API Level is an integer value that uniquely identifies the framework API revision offered by a version of the Android platform. The Android platform provides a framework API that applications can use to interact with the underlying Android system. The framework API consists of: A core set of packages and classes.

Embedded c:
Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems. Embedded C programming requires nonstandard extensions to the C language in order to support exotic features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations. In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C, e.g., main() function, variable definition, datatype declaration, conditional statements

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(if, switch case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, etc.

Concept of IoT

The Internet of Things (IOT) is a worldwide network of intercommunicating devices. It integrates the ubiquitous communications, pervasive computing, and ambient intelligence.IOT is a vision where "things", especially everyday objects, such as all home appliances, furniture, clothes, vehicles, roads and smart materials, etc. are readable, recognizable, locatable, addressable and/or controllable via the Internet. Internet of Things will connect the world's objects in both a sensory and intelligent manner through combining technological developments in item identification ("tagging things"), sensors and wireless sensor networks ("feeling things"), embedded systems ("thinking things") and nanotechnology ("shrinking things").

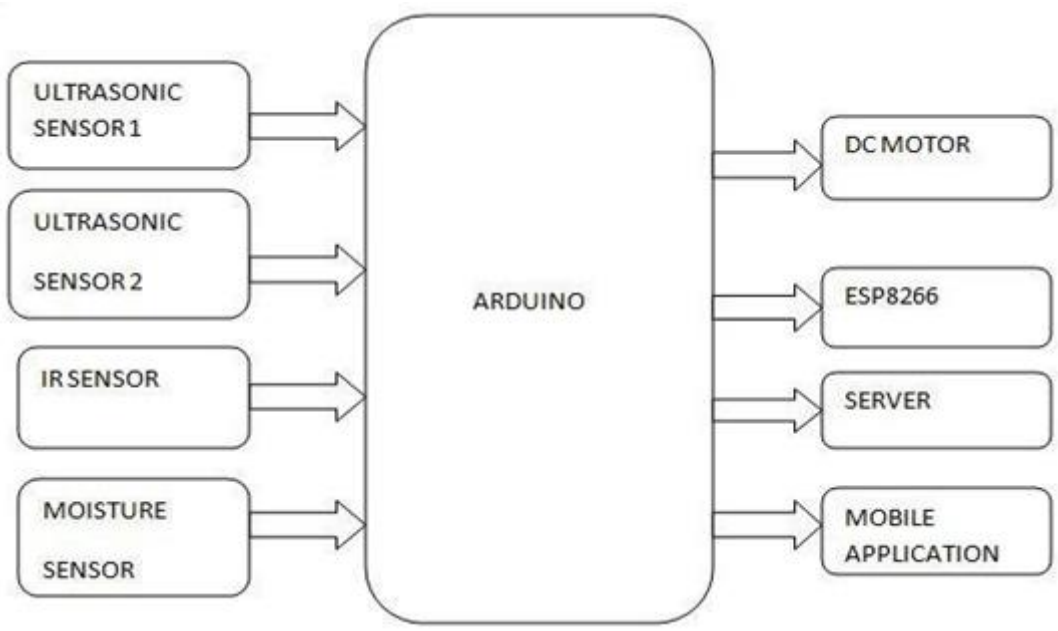

Figure: Schematic diagram of the smart waste management system

Working

Ultrasonic sensor measure the amount of waste contained in the dumpsters by using ultrasonic waves. The sensors emits an ultrasonic wave and receives the reflected wave back from the target. Hence it detects the quantity. IR Sensor emits in order to sense some aspects of the surroundings .Moisture Sensor measures the volumetric water content in the soil. Reflected microwave radiation is affected by the soil moisture and is used for remote sensing hydrology and agriculture. By the combined action of the IR sensor and moisture sensor the wet and dry waste segregate each other.DC motor which is connected to the digital pins of Arduino Mega.We are using serial monitor for the display to exhibiting the content of the dumpsters.

3. RESULTS AND DISCUSSION

The proposed system requires less maintenance cost than the existing system. Thereis a need to make it a sustainable which is the development cost is acceptable to implement in localauthority. The most important thing is how to deliver by local authority with th great awareness. With the current system, the implementation only limited for apartment and condominium which the sensor device put on top of the big garbage bin inside of apartment wastechamber. In the future, small IoT gadget for waste monitoring can be develop and put inside the wastechamber in front of each terrace house and bungalow to widening the implementation to the citizen.

4. CONCLUSION

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This project deals with an effective method of managing waste in any big city. On considering conventional periodic collection method, this priority system is used to the city is clean all the time without any overflowing dumpsters. It has been tested and verified properly to make sure that all the different part of the system work together for a smooth function of the whole system.

5. ACKNOWLEDGEMENTS

We would like to thank our respected Principal Dr. S Anandaresmi for her great support .And we would like to thank our HOD and Project guide Prof.Navitha K Krishnan for great guidences for success of the project.

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