ISSN: 1832-5505

Applied GIS

Vol-8 Issue-04 Oct 2020

Sensor-based waste management for smart cities

Rampriya.R[1],Pradeep.K[2], Karthick.S[3] Assistant Professor[1]
CK College of Engineering & Technology,
Chellangkuppam,
Cuddalore.

***Abstract*—** The gap between urban areas and their surrounding garbage dumps has widened in recent decades. The proper handling of garbage has long been a problem in the United States. Overflowing trash cans or mothball containers are a common sight in our city. It makes the area unattractive and unhealthy for those who live there, not to mention smelly. This initiative represents a cutting-edge strategy for the mechanization of trash management. The technology tracks the depth of trash cans around the city and compares the results. The Arduino UNO board will serve as the hub for communicating with the Wi-Fi module, Infrared Sensor, Gas Sensor, and Flame Sensor that will be used in our project. Atop each moth bin is an infrared sensor used for monitoring the bin's present state. When the garbage in the moth bin reaches a certain level, a sensor will activate and send out a constant alarm via the Wi-Fi Module to the necessary District Deputy Director and Municipal Sway. As part of a larger safety system, the Gas Sensor may be used to determine whether harmful gasses are present.Many gasses are potentially dangerous to organic life such as people and animals, making this sort of equipment crucial. When a fire or flame is present, the Flame Sensor may be activated to take appropriate action. Due to the mechanics and technology it employs, a flame detector may frequently react more quickly and precisely than a smoke or heat detector. The app will get real-time status updates. Our goal is to contribute people and energy toward improving a shrill city ideal.

Keywords—Arduino Uno;IR sensor;Flame sensor; Gas sensor;

Introduction

The government of India has launched a campaign called "Swachh Bharat Abhiyan" with the goal of making the country completely clean. On October 2, 2014, the 145th anniversary of Mahatma Gandhi's birth, the government of India formally started this campaign in his honor. The father of the country, Mahatma Gandhi, had declared "Sanitation is more important than Independence" before India gained its independence. He was well aware of the filthy and dangerous conditions in India. To the Indian people, he had repeatedly hammered home the need of personal hygiene and public sanitation. The fundamental aims of starting the Swachh Bharat Mission are to create the nation full of sanitary facilities as well as remove all the harmful habits of people in everyday routines. We at CKCET helped out by developing a computerized monitoring system that might have a significant impact on the Clean India initiative. One such technology is Universal Object Interaction, which centers on the capacity for billions of intelligent and detecting gadgets to communicate with one another and share data. The phrase "Universal Object Interaction" refers to a wireless connection between the things utilizing Internet with RFID, Sensor, Shriek Tech and Nano Tech. As early as 1999, the name "Kevin Ashton" was being utilized. The process of transmitting information via a network without involving any human, machine, or human-machine interactions of any kind. These days, there is a widening gulf between population and trash management. Our nation has significant challenges related to waste management. The trash cans and mothball containers in public spaces like schools, churches, and malls are always stuffed to capacity. Most infectious diseases are caused by bacteria and viruses, and these circumstances foster the growth of both. The "Junk Automation Monitoring in Urbanization Using Universal Object Interaction" initiative is an approach via which municipal waste administration

has been computerized. This system monitors all the rubbish bins positioned across the city and measures the depth as whether to be filled or not. We are going to construct our project utilizing the interfaces of Arduino UNO r3 board with Wi-Fi Module, Infrared Sensor, Gas Sensor and Flame Sensor. The Infrared Sensor is mounted on top of the moth bins and is used to determine their present state. The Gas Sensor is a device used in safety systems to detect the presence of gases in a certain region.There are various gasses that are toxic to organic life, making this sort of device crucial. When a fire or flame is present, the Flame Sensor may be activated to take appropriate action. Due to the mechanics and technology it employs, a flame detector may frequently react more quickly and precisely than a smoke or heat detector. Indicators for low, medium, and high levels were formerly utilized. In addition to alerting the Deputy Director and Municipal Swag with a continuous siren if the level in the bins becomes too high, the sensor will also provide this information to them. The status of any garbage that is discarded will be updated instantly on the app. There are Administrators, District Assistant Directors, Health Inspectors, Municipal Power Brokers, and Citizens included on the application. The main administrator uses the admin module to manage all of the system's features. The garbage level, bin status, bin ID, and position may all be checked and changed with the use of the Municipal Sway module. Our goal is to contribute people and time to improving the city with a clear vision.

Literature Survey

ISSN: 1832-5505

Applied GIS

Vol-8 Issue-04 Oct 2020

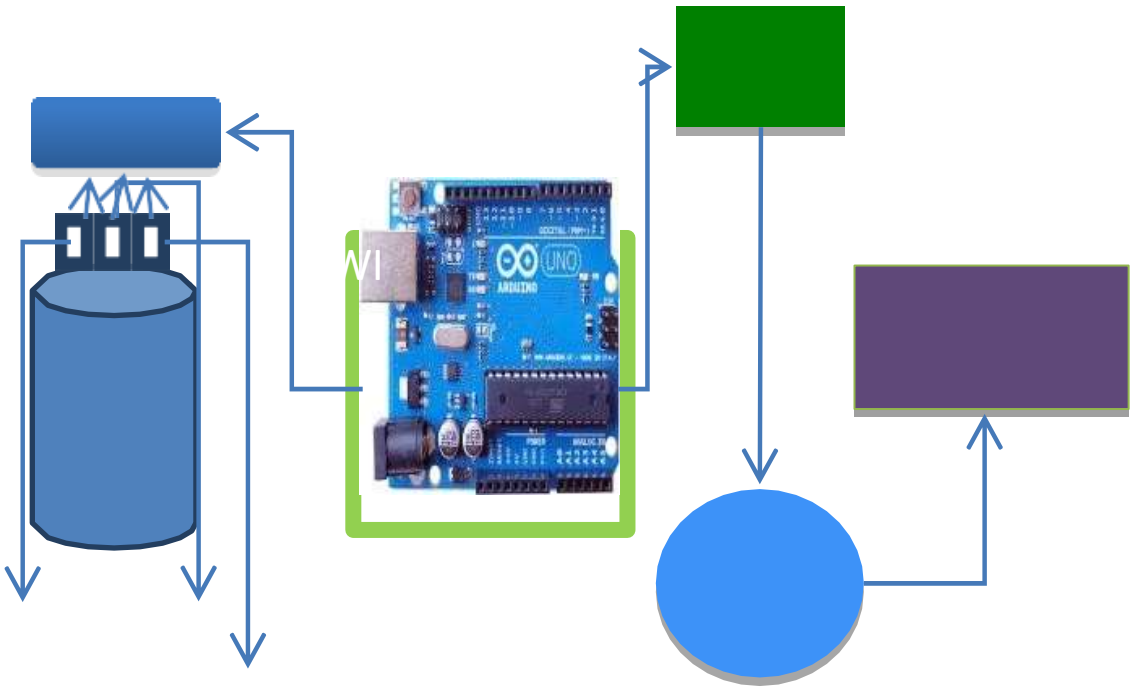
For a long time, the concept of a shrieking trash can has been fascinating. After the growth of UOI field, we are discovering its grasp on our life. For data transmission, we're using an Arduinouno r3, as well as an Infrared Sensor, Gas Sensor, Flame Sensor, and Wi-Fi Module. There are a wide variety of waste streams, including but not limited to: organic, inorganic, and package waste. The number of moths and the current distribution of moth traps are analyzed in [1]. It was evident that there was a lack of waste containers in the region. All of the trash cans have been discovered to be burning, adding to environmental pollution. The camera and the load cell sensor at the bottom of the garbage can are part of a larger framework that the developers of [2] have developed. The camera constantly shoots pictures of the garbage cans. By comparing the data from the camera and the load sensor, the desired fill level may be determined. Sensors in trash cans are a key component of a waste management system. Wi-Fi Module alerts municipal authority when trash accumulation exceeds a certain threshold. A number of components, including garbage, household bins, trash bags, communal containers, and collection trucks, go into making up a waste management system. The garbage should begin its journey at the garbage cans and conclude at the garbage trucks. The Infrared Sensor is utilized for Junk Detection. Infrared (IR) sensors emit light that is undetectable to the naked eye but can be picked up by other electronics. When trash cans approach capacity, this mechanism triggers prompt cleaning.

SYSTEM ARCHITECTURE

This is a cutting-edge solution that will aid in the cleanliness of urban areas. Through a web interface, this system tracks the quantity of moth bins and compiles data on their contents. To monitor the garbage, fire, and gas levels, we employ infrared sensors, flame sensors, and gas sensors, all of which are mounted on the lids of the containers. The system makes use of Arduino microcontroller, LCD display, Wi-Fi modem for delivering data with location and a buzzer. The LCD screen shows the current moth bin fill levels.

The online software is utilized to display the moth bins current status with location to the government agency to monitoring it. The online program provides a graphical representation of the moth bins, with different colors representing different amounts of trash.

The current state of the trash, flame, and gas is shown on the LCD screen. When the threshold is reached, the system sounds an alarm. By transmitting the moth bins' levels via a graphical depiction of the bins on a web website, this technique aids in keeping the city clean.

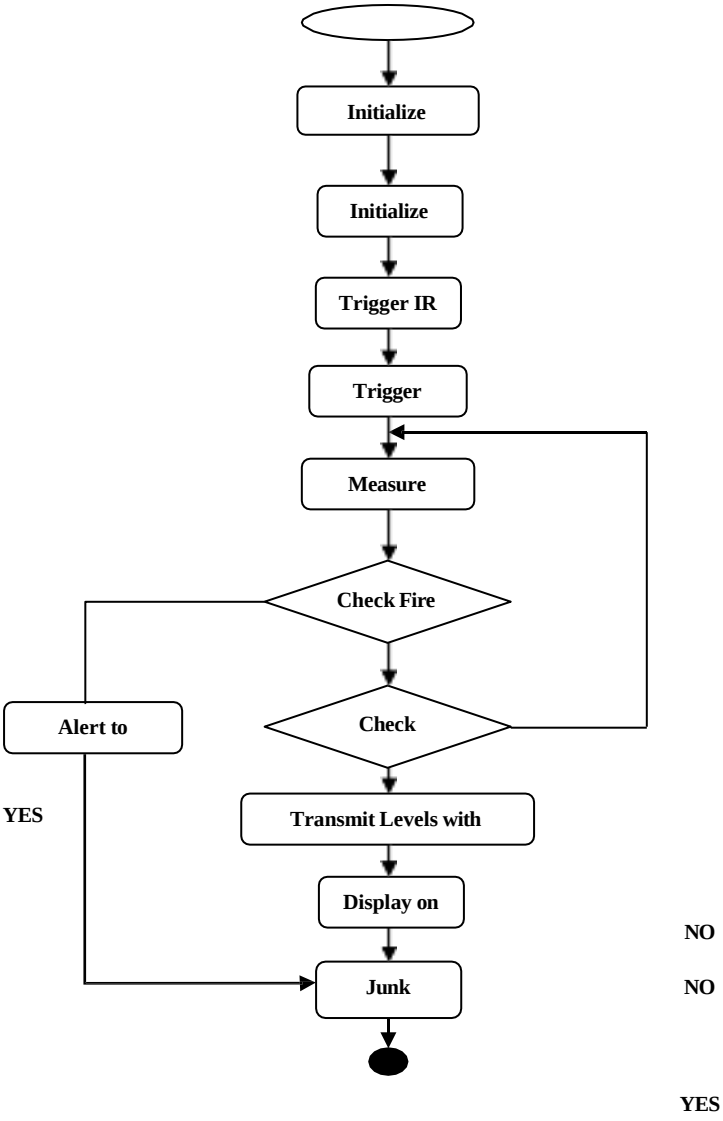


Applied GIS

ISSN: 1832-5505

Vol-8 Issue-04 Oct 2020

FLOW CHART



HARDWARE COMPONENTS USED

A. Arduino Uno R3Microcontroller

The Arduino Uno R3 is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

B. Wi-Fi Modem

The ESP8266 series, or family, of Wi-Fi chips is produced by Espressif Systems, a fabless semiconductor company operating out of Shanghai, China. The ESP8266 series presently includes the ESP8266EX and ESP8285 chips. **ESP8266EX** (simply referred to as ESP8266) is a system-on-chip (SoC) which integrates a 32-bit Tensilica microcontroller, standard digital peripheral interfaces, antenna switches, RF balun, power amplifier, low noise receive amplifier, filters and power management modules into a small package. It provides capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), Inter-Integrated Circuit (I^2C), analog-to-digital conversion (10-bit ADC), Serial

ISSN: 1832-5505
Vol-8 Issue-04 Oct 2020

Peripheral Interface (SPI), I²S interfaces with DMA (sharing pins with GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). The processor core, called "L106" by Espressif, is based on Tensilica's Diamond Standard 106Micro 32-bit processor controller core and runs at 80 MHz (or overclocked to 160 MHz). It has a 64 KB boot ROM, 64 KB instruction RAM and 96 KB data RAM. External flash memory can be accessed through SPI. The silicon chip itself is housed within a 5 mm × 5 mm Quad Flat No-Leads package with 33 connection pads — 8 pads along each side and one large thermal/ground pad in the center.

C. Infrared Sensor

Infrared radiation is the portion of electromagnetic spectrum having wavelengths longer than visible light wavelengths, but smaller than microwaves, i.e., the region roughly from 0.75µm to 1000 µm is the infrared region. Infrared waves are invisible to human eyes. The wavelength region of 0.75µm to 3 µm is called near infrared, the region from 3 µm to 6 µm is called mid infrared and the region higher than 6 µm is called far infrared. It is emitted by objects with temperature above 0kelvin. Furthermore intensity and wavelength of infrared radiation depends on the temperature of the object. The infrared sensors are the sensors that detect/measure infrared radiation or change in the radiation from outer source or inbuilt source. Also, sensors that uses the property of infrared radiations to detect the changes in surrounding are termed as infrared sensors.There are two types of infrared sensor based on its function: Thermal Infrared sensor and Quantum infrared sensor. These are the types of infrared sensors based on the working mechanism: Active Infrared Sensors and Passive Infrared sensors.

D. Gas Sensor

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.Exposure

to toxic gases can also occur in operations such as painting, fumigation, fuel filling, construction, excavation of contaminated soils, landfill operations, entering confined spaces, etc. Common sensors include combustible gas sensors, photo ionization detectors, infrared sensors, ultrasonic sensors, electrochemical gas sensors, and semiconductor sensors. More recently, infrared imaging sensors have come into use. All of these sensors are used for a wide range of applications and can be found in industrial plants, refineries, pharmaceutical manufacturing, fumigation facilities, paper pulp mills, aircraft and shipbuilding facilities, hazmat operations, waste-water treatment facilities, vehicles, indoor air quality testing and homes.

E. Flame Sensor

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is properly lit; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame.

Implementation & Methodology

In this paper, Nodemcu ESP8266 Wi-Fi Development Board is used to transmit the data's. It provides capabilities for 2.4 GHz Wi-Fi (802.11 b/g/n, supporting WPA/WPA2), general-purpose input/output (16 GPIO), Inter-Integrated Circuit (I²C), analog-to- digital conversion (10-bit ADC), Serial Peripheral Interface (SPI), I²S interfaces with DMA (sharing pins with GPIO), UART (on dedicated pins, plus a transmit-only UART can be enabled on GPIO2), and pulse-width modulation (PWM). The infrared sensor is used to find the level of junk filled at

ISSN: 1832-5505

Vol-8 Issue-04 Oct 2020

different intervals of time, the Flame sensor is used to detect the flame level and gas sensor is used to detect the natural gas levels in the bin and these are placed at top of the bin.

Arduino Uno r3 board is used as microcontroller platform. . It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Whenever the level reaches its threshold value, Wi-Fi modem is activated to send an alert with buzzer to the government sway through an Email.

When an Email alert is received, the sway informed to the workers for cleaning the filled bins on time without allowing them to overflow.

Advantages

1. Easy to detect the fill level, flame level & gas level in the moth bins.
2. Reduce the human resources and efforts.
3. Reduce the cost & complexity.
4. Easy to control & monitor the whole system.

Conclusion

Implementation of real time junk automation monitoring by using mothbins to check whether thebins are full or not and to check the natural gas or flame are emitted from the moth bins. By implementing this system we will avoid over flowing of junk from the container in residential area which is either loaded by manually or with the help of loaders in trucks and the reduction of

cost, human resources and efforts usage of the moth bins also be done and saves huge time. By reducing unnecessary rounds for junk collection, this system indirectly reduces traffic in the city. This system will inform the status of every moth bin in real time located throughout the city, so that the government sway can dispatch the junk collecting vehicles only when the bins are completely full or it reaches to full. In urban cities, depends on the population of the particular area, the junk collecting vehicles can visit there for everyday twice or thrice and sometimes these moth bins may or may not be full. It is user- friendly system.

REFERENCES

[1] M.T.H. Shubho, M.T Hassan, M.R. Hossain and M. N. Neema, "*Quantitative Analysis of Spatial Pattern of Dustbins and its Pollution in Dhaka City–A GIS Based Approach"*, Asian Transactions on Engineering (ATE ISSN: 2221-4267) Vol. 03, Issue 04, September 2013, pp.1-7.

[2] Prof. R.M.Sahu, Akshay Godase, Pramod Shinde, Reshma Shinde, "*Garbage and Street Light Monitoring System Using Internet of Things*", International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering Vol. 4, Issue 4, April 2016.

[3] Monika K A, Rao N, Prapulla S B and Shobha G 2016 *"Smart Dustbin-An Efficient Garbage Monitoring System*"International Journal of Engineering Science andComputing Vol. 6, Issue 6, June 2016.

[4] Vishesh Kumar Kurre, "*Smart Garbage Collection Bin overflows Indicator using IOT"*, International Research Journal of Engineering and Technology (IRJET) Vol. 3, Issue 5, May 2016.

[5] Prof. Rashmi P M, Akash k t, Dineshchoudhari S Y, Sandeep C U, "*IOT Based Garbage Monitoring System"*, International Journal of Advanced Research in Computer Engineering and Technology (IJARCET) Vol. 6, Issue 4, April 2017.