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MANAGEMENT AND SEGREGATION OF GARBAGE BINS AUTOMATION

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ABSTRACT

Waste is defined as any material that is not useful and represents no economic value to its owner, the waste generator. Depending on the physical state of waste, they are categorized as solid, liquid and gaseous. Waste Management involves planning, financing, construction and operation of facilities for the collection, transportation, recycling and final disposition of the waste. Every five years the waste generated is rising by 1 million tons, In case it is not disposed within a stipulated time, it tends to create serious health hazards and reflects negatively on the infrastructure. The existing garbage disposal system, where it is collected from the streets, houses and other establishments once a day, is not able to effectively manage the waste generated, resulting in spill over on streets. Bangalore metropolitan city municipal council deployed concrete dustbins at every street corner to collect the garbage, engaged its labourers and vehicles to clear the trash. The municipal efforts did not pay any dividend and hence it had to eliminate the bins since residents would litter garbage around the bin once the bins were full. Consequently, concrete dustbins were replaced by the door- to-door garbage collection system, which was also ineffective in its implementation. The Indian National Capital Territory, Delhi is rapidly growing and so is its corresponding waste production. 85% of the city does not have a formal door-to-door trash pick-up system. The Municipal waste, which is not always properly segregated at the source, often ends up as mixed waste in the already overflowing landfills.

I. EXISTING SYSTEM

Fig 1.1 Existing system

This is our daily sight of the garbage that we are bitterly forced to see. The main problem with this system is that people are not aware of what the disposal and management is. This might lead to the various contamination and spread of diseases. Garbage collection algorithms have been developed for a wide range of application types, but the techniques have, unfortunately, so far suffered from problems with complying with very strict real-time demands. They are in most cases targeted for batch or interactive systems and do not guarantee short enough response times. Memory management inevitably involves some overhead. The overhead can consist of additional space requirements, additional time requirements, or more often a combination of the two. The time overhead is sometimes measured as the percentage of CPU time needed for memory management. For real-time systems this measure alone is not an adequate measure of the overhead. For such systems to meet their timing requirements, it is important that the garbage collector does not delay the application for extended periods. Operations that could cause the garbage collector to be invoked, thus interrupting the execution of the application program, must have a short and bounded time overhead. Using some knowledge of when and how the most time-critical parts of the system execute, the strategy can guarantee that garbage collection will never disturb these parts.

2. HARDWARE COMPONENTS

2.1 ULTRASONIC SENSOR

Ultrasonic sensors are devices that use electrical– mechanical energy transformation to measure distance from the sensor to the target object. Ultrasonic waves are longitudinal mechanical waves which travel as a sequence of compressions and rarefactions along the direction of wave propagation through the medium. Apart from distance measurement, they are also used in ultrasonic material testing (to detect cracks, air bubbles, and other flaws in the products), Object detection, position detection, ultrasonic mouse, etc. It consists of a transmitter and receiver which are available as separate units or embedded together as single unit. The above image shows the ultrasonic transmitter and receiver. It transmits ultrasonic waves from its sensor head and again receives the ultrasonic waves reflect from an object. By measuring the length of time from the transmission to reception of the sonic wave, it detects the position of the object. Ultrasonic sensors can measure the following parameters without contacting the medium to be measured distance, level, Diameter, Presence and Position Range: 40 to 70 kHz frequency Up to 11 m of distance and -25° C to +70° C operating temperature.

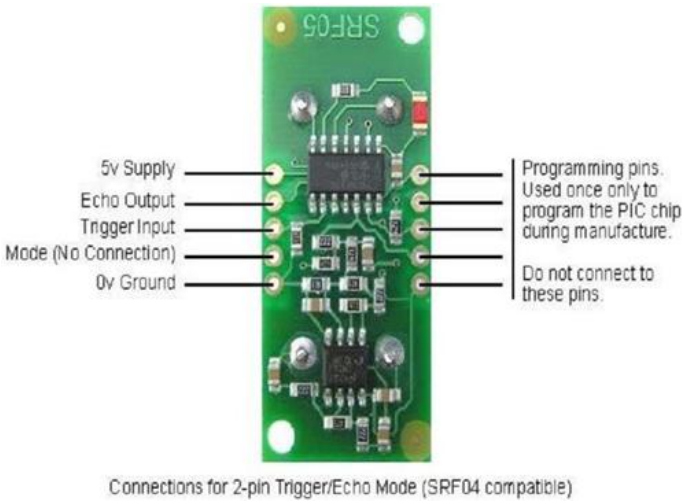


Fig 2.1 diagram show the pin diagram and I/O ports of an Ultrasonic sensor

A. GASSENSOR

Fig 2.2 Diagram of 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 and 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. Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. The top part is a stainless-steel mesh which takes care of the following Filtering out the suspended particles so that only gaseous elements are able to pass to insides of the sensor. Protecting the insides of the sensor. Exhibits an anti-explosion network that keeps the sensor module intact at high temperatures and gas pressures.

The sensing element which is made up from Aluminium Oxide based ceramic and has a coating of tin oxide. Using a ceramic substrate increases the heating efficiency and tin oxide, being sensitive towards adsorbing desired gas components (in this case methane and its products) suffices as sensing coating.

The ceramic with tin dioxide on the top coating that has good adsorbing property. Any gas to be monitored has specific temperature at which it ionizes. The task of the sensor is to work at the desired temperature so that gas molecules get ionized. Through Nickel-chromium wire, the ceramic region of the sensing element is subjected to heating current. The heat is radiated by the element in the nearby region where gases interact with it and get ionized.

Once, ionized, they are absorbed by the tin dioxide. Adsorbed molecules change the resistance of the tin dioxide layer. This changes the current flowing through the sensing element and is conveyed through the output leads to the unit that controls the working of the gas sensor.

2.2 ESP8266 (WiFi)

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi 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 Wi-Fi ability as a Wi-Fi 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. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co- existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

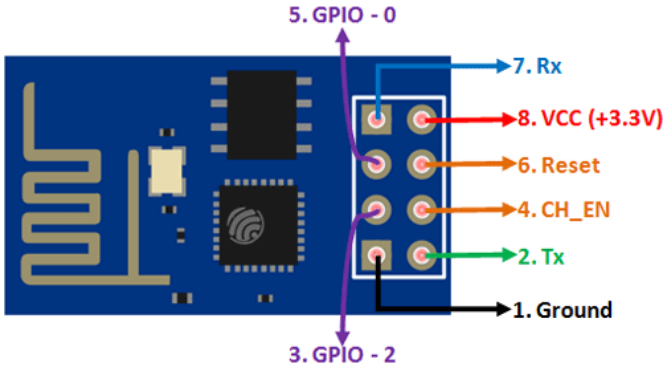
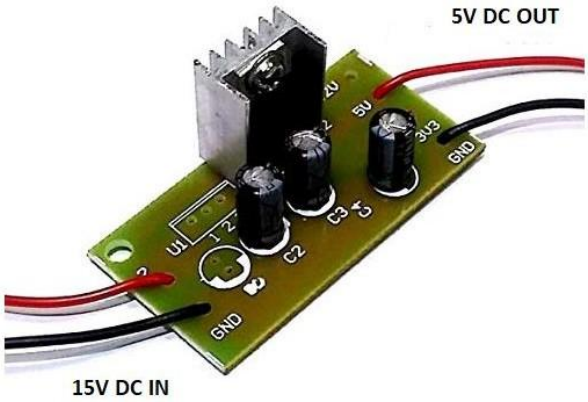


Fig 2.3 in out of the Wi-Fi module

2.3 POWERING ESP8266 USING 7805 VOLTAGE REGULATOR



A voltage regulator is a circuit that creates and maintains a fixed output voltage, irrespective of changes to the input voltage or load conditions. Voltage regulators (VRs) keep the voltages from a power supply within a range that is compatible with the other electrical components. The presence of the two 100 µF Capacitors is used to cancel out any kind of ripple present from the constant 5V output that comes out of the 7805 voltage regulators.

2.4 ARDUINO NANO

Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures microcontroller-based kits for building digital

devices and interactive objects that can sense and control objects in the physical world. The project is based on microcontroller board designs, manufactured by several vendors, using various microcontrollers. These systems provide sets of digital and analog I/O pins that can be interfaced to various expansion boards ("shields") and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on the Processing project, which includes support for the C and C++ programming languages.

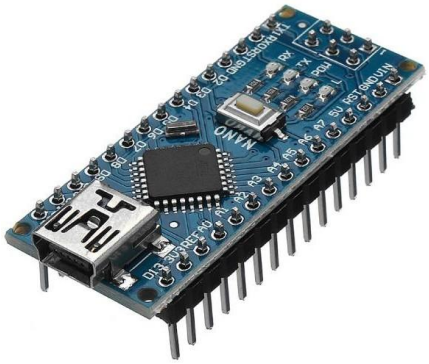


Fig 2.5 ARDUINO NANO

Arduino programs may be written in any programming language with a compiler that produces binary machine code. Atmel provides a development environment for their microcontrollers, AVR Studio and the newer Atmel Studio. The Arduino project provides the Arduino integrated development environment (IDE), which is a cross-platform application written in Java. It originated from the IDE for the Processing programming language project and the wiring project. The Arduino IDE supports the C and C++ programming languages using special rules of code organization. The Arduino IDE supplies a software library called "Wiring" from the Wiring project, which provides many common input and output procedures. A typical Arduino C/C++ sketch consist of two functions that are compiled and linked with a program stub main() into an executable cyclic executive program:

• setup(): a function that runs once at the start of a program and that can initialize settings.
• loop(): a function called repeatedly until the board powers off.

After compilation and linking with the GNU tool chain, also included with the IDE distribution, the Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal coding that is loaded into the Arduino board by a loader program in the board's firmware.

3 PROPOSED SYSTEM

We are living in an age where tasks and systems are fusing together with the power of IOT to have a more efficient system of working and to execute jobs quickly! With all the power at our finger tips this is what we have come up with. The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different systems, while providing data for millions of people to use and capitalize. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system. One of the main concerns with our environment has been solid waste management which impacts the

health and environment of our society. The detection, monitoring and management of wastes is one of the primary problems of the present era. The traditional way of manually monitoring the wastes in waste bins is a cumbersome process and utilizes more human effort, time and cost which can easily be avoided with our present technologies. This is our solution, a method in which waste management is automated. This is our IoT Garbage Monitoring system, an innovative way that will help to keep the cities clean and healthy.

4 BLOCK DIAGRAM

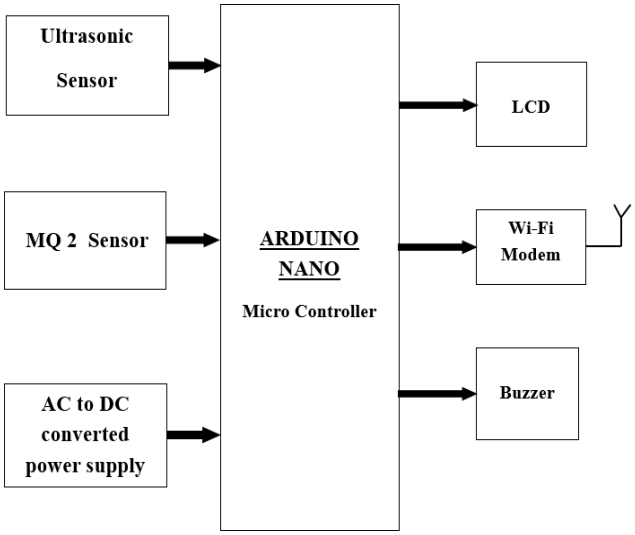


Fig 4.1 Block diagram of the proposed work

This block diagram defines the various inputs and outputs of the automation process of the garbage bins. The initial power supply for the entire device is given through an adapter to a step down transformer. And this step downed unstable AC is sent to the combination of diodes in the form of wheat stone bridge and voltage regulators and capacitors to get the final stable DC voltage of 5V from the 220V unstable AC supply which as a whole given to the Arduino. The usage of two sensors i.e Ultrasonic sensor and the Gas sensor senses their respective happenings and sends the signal to the Arduino NANO microcontroller with the help of ADC. The microcontroller sends signal to the Wi-Fi module and if the Wi-Fi module is connected properly with the microcontroller it sends an acknowledgement signal back to the microcontroller. The LCD display shows the level filled up, the gas level and the alert signal according to the changes sensed by the sensors which are sent to the Arduino which reflects on the screen of the LCD. The buzzer acts as the alarm which gives out sound whenever the level and the gas sensed by the sensors are out of the normality range. Here Arduino acts as Microcontroller and also as a gateway. Using the concept of IoT, Arduino sends every details to the cloud via Wi-Fi module. The data from the cloud is sent to mobile phone app or can be viewed in the respective webpage of the sever that holds the information and is automated by the ESP8266.

5 UPLOADING DATA TO THINGSPEAK.COM

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by your devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak you can perform online analysis and processing of the data as it comes in.

ThingSpeak is often used for prototyping and proof of concept IoT systems that require analytics. ThingSpeak allows you to aggregate, visualize and analyze live data streams in the cloud.

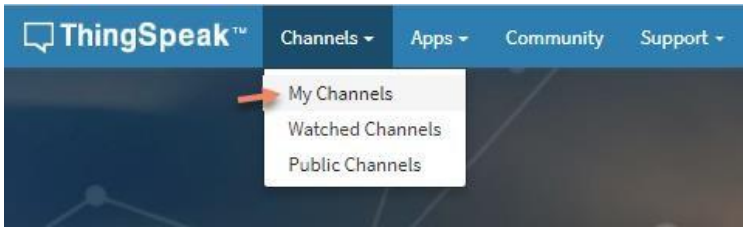
Some of the key capabilities of ThingSpeak include the ability to:
• Easily configure devices to send data to ThingSpeak using popular IoT protocols.
• Visualize your sensor data in real-time.
• Aggregate data on-demand from third-party sources.
• Use the power of MATLAB to make sense of your IoT data.
• Run your IoT analytics automatically based on schedules or events.
• Prototype and build IoT systems without setting up servers or developing web software.
Automatically act on your data and communicate

On the left, we have the smart devices (the "things" in IoT) that live at the edge of the network. These devices collect data and include things like wearable devices, wireless temperatures sensors, heart rate monitors, and hydraulic pressure sensors, and machines on the factory floor.

In the middle, we have the cloud where data from many sources is aggregated and analyzed in real time, often by an IoT analytics platform designed for this purpose.

The right side of the diagram depicts the algorithm development associated with the IoT application. Here an engineer or data scientist tries to gain insight into the collected data by performing historical analysis on the data. In this case, the data is pulled from the IoT platform into a desktop software environment to enable the engineer or scientist to prototype algorithms that may eventually execute in the cloud or on the smart device itself.

CREATING A CHANNEL TO COLLECT NEW DATA
Here is an example of creating a channel to collect new data.
1. Sign In to ThingSpeak™ using your MathWorks ® Account, or create a new Math Works account.
2. Click Channels >MyChannels.



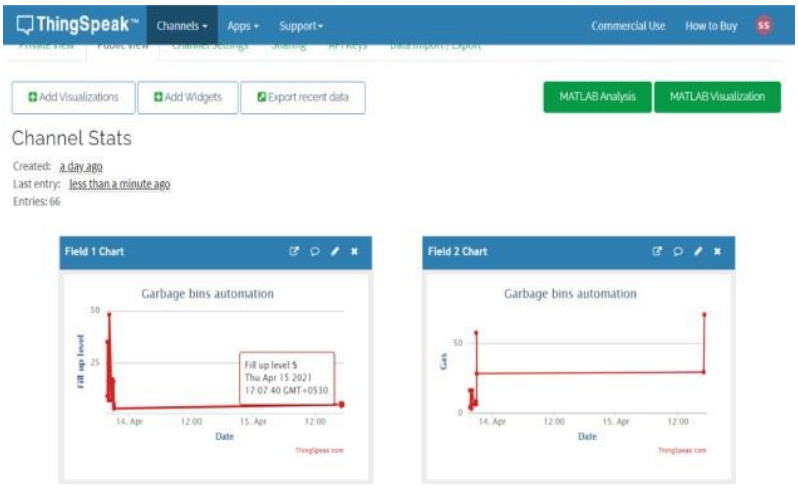
3. On the Channels page, click New Channel.
4. Check the boxes next to Fields 1–3. Enter these channel setting values:

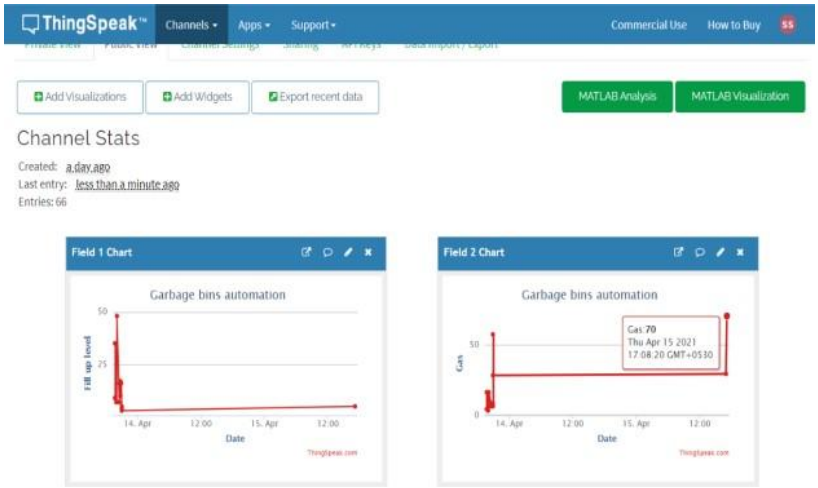
Name: GARBAGE AUTOMATION
Description : This project monitors….
Field 1: FILL UP LEVEL
Field 2: GAS

5. Click Save Channel at the bottom of the settings. You now see these tabs:

Private View: This tab displays information about your channel that only you can see.
Public View: If you choose to make your channel publicly available, use this tab to display selected fields and channel visualizations.
Channel Settings: This tab shows all the channel options you set at creation. You can edit, clear, or delete the channel from this tab.
Sharing: This tab shows channel sharing options. You can set a channel as private, shared with everyone (public), or shared with specific users.
API Keys: This tab displays your channel API keys. Use the keys to read from and write to your channel.
Data Import/Export: This tab enables you to import and export channel data.

6. OUTPUT





7. CONCLUSION

The Project garbage management has been completed successfully and the output results are verified. The results are in line with the expected output. The project has been checked with both software and hardware testing tools. In this work I/O devices are chosen and proved to be more appropriate for the intended application. The project is having enough avenues for future enhancement. The project is a prototype that fulfils all logical requirements and this project is applicable for real time application. This project contributes significant field in the field of solid waste management. The work carried out is suitable for peripheral upgradation in future and also applicable to variety of industrial and commercial applications.

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