E-Dustbin

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Guide
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Table of Contents	Page no.
Abstract	I
List of Figures -Wireless Sensor network -Micro controller intel 8742 -Transceiver -IR Sensor -Ultrasonic Sensor -Process -Bus topology - Tree -Star -Ring - Mesh - Circular -Grid -WSN Application -motive -led blinking -Blynk App Notification	II (i) (ii) (iii) (iv) (v) (vi) (vii) (viii) (ix) (x) (xi) (xii) (xiii) (xiv) (xv) (xvi) (xvii)
Chapter 1 Introduction -What is Wireless Sensor Network -Characteristics of WSN -Enabling Technologies of WSN - Network topologies of WSN -Applications of WSN -Security aspects of WSN -WSN design methodology	7
Chapter 2 Review of Literature	22
Chapter 3 Problem Statement	23

Chapter 4 Objectives	24
Chapter 5 Project Details/Flow	25
Chapter 6 Circuit Diagram	26
Chapter 7 Requirement of software and hardware	27
Chapter 8 Implementation	28
Chapter 9 Testing	31
Chapter 10 Result	33
Chapter 11 Conclusion	34
References	35
Reference Papers	36

Approval for Project Report for IOT Lab semester V

This project report entitled *" E-Dustbin "* is approved for semester VI in partial fulfillment of the requirement for the Sensor Network Lab Lab of T.E. Engineering.

Examiners

1.______________________________

2.______________________________

Guide

1.______________________________

2.______________________________

Abstract

A clean environment is nothing short of a necessity. We all know that unclean and filthy surroundings can breed disease-causing microorganisms galore. India has started taking actions to clean the country but still the results are not up to the mark. We need this system to ensure the advancement of cleanliness in the country by encouraging people to use E-Dustbin having a unique Dustbin mechanism and many more. There are no E-Dustbins available in India. Our E-Dustbin will inform the Authorized person when to pick the garbage. This will ensure efficiency of maintaining the surrounding clean. Also, in India there are no Dustbins in Public Transport(Bus). Our mechanism for Transport Bin is really cheap and will be ensure that citizens don't throw waste out of the window which will keep roads clean.

List of Figures

FIGURE NO.	PAGE NO.
Fig.(i)	6
Fig (ii)	7
Fig (iii)	8
Fig (iv)	11
Fig (v)	11
Fig (vi)	12
Fig (vii)	14
Fig (viii)	15
Fig (ix)	16
Fig (x)	16
Fig (xi)	17
Fig (xii)	18
Fig (xiii)	19
Fig (xiv)	20
Fig (xv)	31
Fig (xvi)	32
Fig (xvii)	32

Chapter 1 : Introduction

Definition

A dynamic network infrastructure with self-configuring capabilities based on the standard and interoperable communication protocols where physical and virtual "things" have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network, often communicate data associated with users and their environments.

1.1 What is Wireless Sensor Network

Wireless sensor network (**WSN**) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind, and so on.

These are similar to wireless ad hoc networks in the sense that they rely on wireless connectivity and spontaneous formation of networks so that sensor data can be transported wirelessly. WSNs are spatially distributed autonomous sensors to *monitor* physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling *control* of sensor activity. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on.

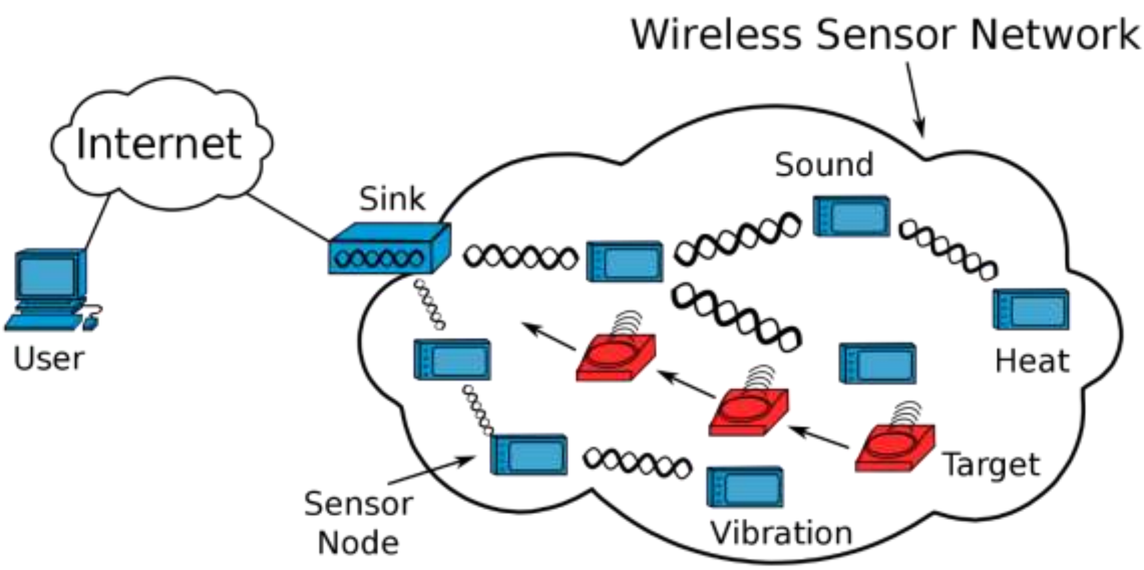


Fig. (i)

1.2 Enabling Technologies of WSN

1.2.1 Sensors Components.

The main components of a sensor node are a microcontroller, transceiver, external memory, power source and one or more sensors.

Controller

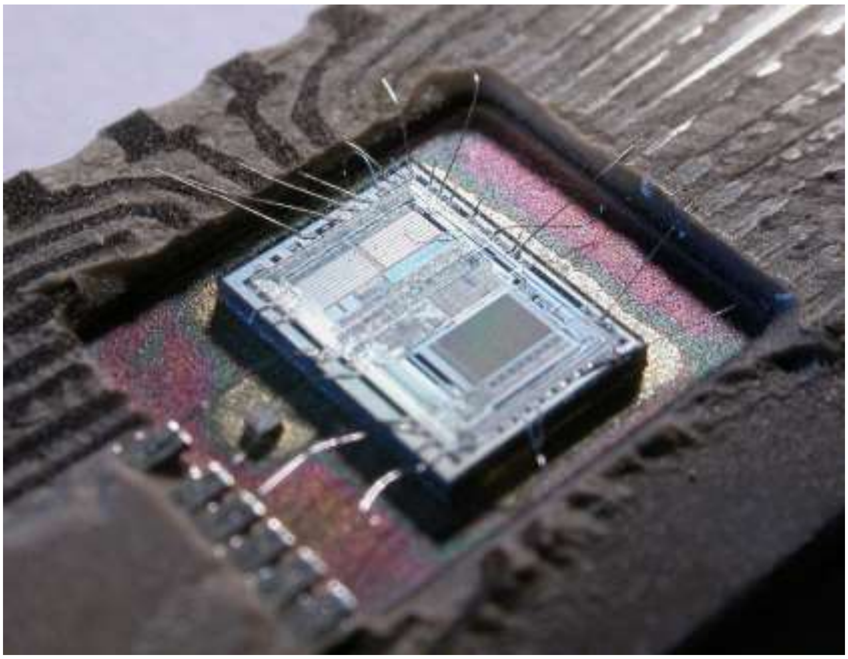


Fig.(ii)

The controller performs tasks, processes data and controls the functionality of other components in the sensor node. While the most common controller is a microcontroller, other alternatives that can be used as a controller are: a general purpose desktop microprocessor, digital signal processors, FPGAs and ASICs. A microcontroller is often used in many embedded systems such as sensor nodes because of its low cost, flexibility to connect to other devices, ease of programming, and low power consumption. A general purpose microprocessor generally has a higher power consumption than a microcontroller, therefore it is often not considered a suitable choice for a sensor node.[*citation needed*] Digital Signal Processors may be chosen for broadband wireless communication applications, but in Wireless Sensor Networks the wireless communication is often modest: i.e., simpler, easier to process modulation and the signal processing tasks of actual sensing of data is less complicated. Therefore, the advantages of DSPs are not usually of much importance to wireless sensor nodes. FPGAs can be reprogrammed and reconfigured according to requirements, but this takes more time and energy than desired.[*citation needed*]

Transceiver

Fig. (iii)

Sensor nodes often make use of ISM band, which gives free radio, spectrum allocation and global availability. The possible choices of wireless transmission media are radio frequency (RF), optical communication (laser) and infrared. Lasers require less energy, but need line-of-sight for communication and are sensitive to atmospheric conditions. Infrared, like lasers, needs no antenna but it is limited in its broadcasting capacity. Radio frequency-based communication is the most relevant that fits most of the WSN applications. WSNs tend to use license-free communication frequencies: 173, 433, 868, and 915 MHz; and 2.4 GHz. The functionality of both transmitter and receiver are combined into a single device known as a transceiver. Transceivers often lack unique identifiers. The operational states are transmit, receive, idle, and sleep. Current generation transceivers have built-in state machines that perform some operations automatically.

Most transceivers operating in idle mode have a power consumption almost equal to the power consumed in receive mode.[6] Thus, it is better to completely shut down the transceiver rather than leave it in the idle mode when it is not transmitting or receiving. A significant amount of power is consumed when switching from sleep mode to transmit mode in order to transmit a packet.

External memory

From an energy perspective, the most relevant kinds of memory are the on-chip memory of a microcontroller and Flash memory—off-chip RAM is rarely, if ever, used. Flash memories are used due to their cost and storage capacity. Memory requirements are very much application dependent. Two categories of memory based on the purpose of storage are: user memory used for storing application related or personal data, and program memory used for programming the device. Program memory also contains identification data of the device if present.

Power source

A wireless sensor node is a popular solution when it is difficult or impossible to run a mains supply to the sensor node. However, since the wireless sensor node is often placed in a hard-to-reach location, changing the battery regularly can be costly and inconvenient. An important aspect in the development of a wireless sensor node is ensuring that there is always adequate energy available to power the system. The sensor node consumes power for sensing, communicating and data processing. More energy is required for data communication than any other process. The energy cost of transmitting 1 Kb a distance of 100 metres (330 ft) is approximately the same as that used for the execution of 3 million instructions by a 100 million instructions per second/W processor.[citation needed] Power is stored either in batteries or capacitors. Batteries, both rechargeable and non-rechargeable, are the main source of power supply for sensor nodes. They are also classified according to electrochemical material used for the electrodes such as NiCd (nickel-cadmium), NiZn (nickel-zinc), NiMH (nickel-metal hydride), and lithium-ion. Current sensors are able to renew their energy from solar sources, Radio Frequency(RF), temperature differences, or vibration. Two power saving policies used are Dynamic Power Management (DPM) and Dynamic Voltage Scaling (DVS).[7] DPM conserves power by shutting down parts of the sensor node which are not currently used or active. A DVS scheme varies the power levels within the sensor node depending on the non-deterministic workload. By varying the voltage along with the frequency, it is possible to obtain quadratic reduction in power consumption.

Sensors

Sensors are used by wireless sensor nodes to capture data from their environment. They are hardware devices that produce a measurable response to a change in a physical condition like temperature or pressure. Sensors measure physical data of the parameter to be monitored and have specific characteristics such as accuracy, sensitivity etc. The continual analog signal produced by the sensors is digitized by an analog-to-digital converter and sent to controllers for further processing. Some sensors contain the necessary electronics to convert the raw signals into readings which can be retrieved via a digital link (e.g. I2C, SPI) and many convert to units such as °C. Most sensor nodes are small in size, consume little energy, operate in high volumetric densities, be autonomous and operate unattended, and be adaptive to the environment. As wireless sensor nodes are typically very small electronic devices, they can only be equipped with a limited power source of less than 0.5-2 ampere-hour and 1.2-3.7 volts.

A. IR Sensor

Fig. (iv)

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 measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

B. Utrasonic Sensor

Fig. (v)

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object.While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily available—they can be had for just a couple dollars in some cases—and in certain situations, they may detect objects more effectively than radar.For instance, while radar, or even light-based sensors, have a difficult time correctly processing clear plastic, ultrasonic sensors have no problem with this. In fact, they're unaffected by the color of the material they are sensing.

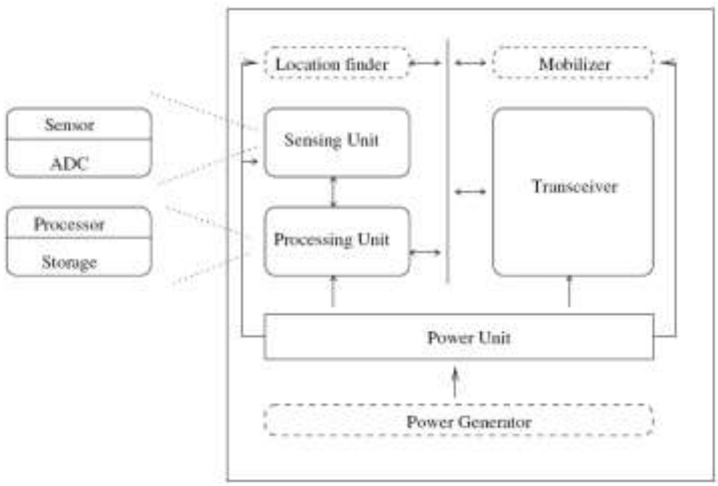


Fig. (vi)

1.2.2 Communication Technology

Communication medium refers to the physical channel through which data is sent and received. Data is sent in the form of voltage levels which make up the digital signal. A digital signal consists of 0s and 1s; essentially, a 1 corresponds to a high voltage, while a 0 corresponds to a low voltage.

The speed of data transmission or data rate depends upon the type of medium being used in the network. There are basically two types of networks:

- Wired network
- Wireless network

In our project we are using wireless medium of communication using GSM module.

1.2.3 Operating System

Sensor networks have severe resource constraints in terms of processing power, memory size and energy, while operating in a communication-rich environment that interfaces both with the physical world and with other sensor network nodes. The operating system must efficiently manage the constrained resources while providing a programming interface, i.e. allow system developers to create resource-efficient software. An operating system multiplexes hardware resources and provides an abstraction of the underlying hardware to make application programs simpler and more portable. Unlike general-purpose computers, which have settled for a number of semi-standardized hardware architectures, sensor network hardware is extremely diverse in terms of processor architectures, communication hardware and sensor devices. This makes operating system design for sensor networks a challenge. In the sensor network research community, several operating systems have been developed, with each offering a different solution for the fundamental problems. TinyOS and Contiki are perhaps the two most well-known systems. TinyOS defines its own programming language called nesC [1], an extension to the C programming language, whereas Contiki uses standard C. Mantis [2], SOS [3] and LiteOS [4] are also widely cited sensor network operating systems. Operating systems for sensor networks share some characteristics with real-time operating systems for embedded systems. Like sensor network nodes, embedded systems also often have severe resource constraints. But unlike embedded systems, sensor network nodes must interact both with the physical world and with each other: sensor networks are highly communicationintensive systems. This communication intensity adds additional challenges in terms of resource management and operating system structure

-Dynamic: Adapattor changing context and taking actions based on operating conditions, user context and sensed environment. Self-configuring: to configure themselves (with respect to the IoT infrastructure), setup the network, upgrade, etc with minimal user intervention .Interoperable protocols: to communication with other IoT devices and with the IoT infrastructure .Identities: each IoT device has a unique identity and a unique identifier (e.g., IP address or URI) Intelligence: Together algorithms and compute (i.e. software & hardware) provide the "intelligent spark" that makes a product experience smart. Consider Misfit Shine, a fitness tracker, compared to Nest's intelligent thermostat. The Shine experience distributes compute tasks between a smartphone and the cloud. The Nest thermostat has more compute horsepower for the AI that makes them smart. Connectivity: Connectivity in the IoT is more than slapping on a WiFi module and calling it a day. Connectivity enables network accessibility and compatibility. Accessibility is getting on a network while compatibility provides the common ability to consume and produce data. If this sounds familiar, that's because it is Metcalfe's Law and it rings true for IoT. Sensing: We tend to take for granted our senses and ability to understand the physical world and people around us. Sensing technologies provide us with the means to create experiences that reflect a true awareness of the physical world and the people in it. This is simply the analog input from the physical world, but it can provide rich understanding of our complex world. Expressing: Expressing enables interactivity with people and the physical world. Whether it is a smart home or a farm with smart agriculture technology, expressing provides us with a means to create products that interact intelligently with the real world. This means more than just rendering beautiful UIs to a screen. Expressing allows us to output into the real world and directly interact with people and the environment. By framing IoT design with these characteristics, multi-discipline teams can work across their domains to make tradeoffs in interaction design, software architectures, and business models. Naturally a single product or service may choose to dial up or dial down these characteristics depending on the nature of user experience and constraints imposed by environmental and business factors.

1.2 Network topologies of WSN

The development and deployment of WSNs have taken traditional network topologies in new directions. Different Wireless sensor network topologies are Bus, Tree, Star, Ring, Mesh, Circular and Grid.

A. Bus Topology

In this topology, there is a node send message to another node on the network sends a broadcast message onto the network that all other nodes see, but only the intended recipient actually accepts and processes the message. Bus topology is easy to install but congestion of traffic and single path communication. However, bus networks work best with a limited number of nodes. If more than a few dozen nodes are added to a network bus, performance problems will likely result improve the road network efficiency. This paper based on the analysis of the shortcomings of traditional technologies, including location technology, communication technology, the advantages of Wireless Sensor Network (WSN) and Zigbee are given first. Then the data requirements of Bus Priority Control System (BPCS) are presentedthis paper presents a framework for real-time bus priority control system. The proposed system architecture integrated active and passive strategies and adding a priority classification level, can provide efficient bus priority control and minimize overall effects to motor vehicle movements under different traffic condition.

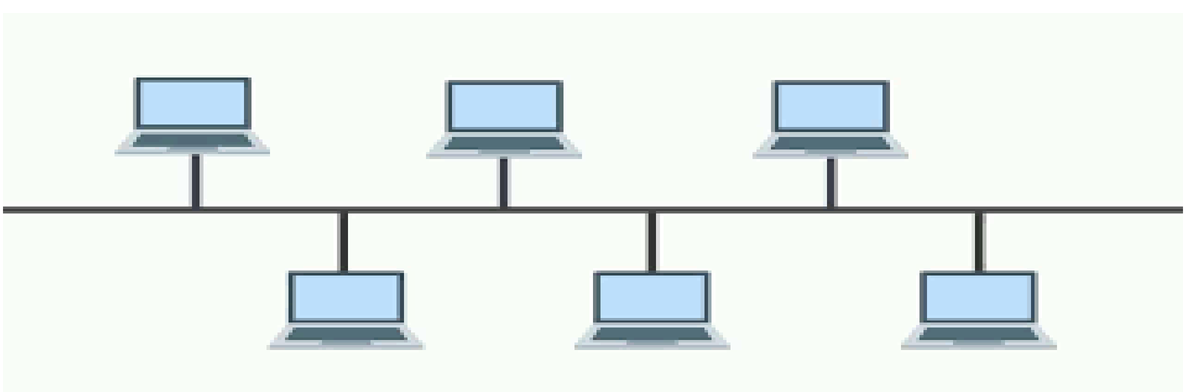


Fig. vii: Bus Topology

B. Tree Topology

The network use a central hub called a root node as the main communication router. In the hierarchy, central hub is one level below from the root node. This lower level forms a star network. The tree network can be considered a hybrid of both the Star and Peer to Peer networking topologies as shown in Fig 2.2. In sensor network path may be single hop or multi hop, sensor node for getting data sense the environment and sent them to the sink and sensor forwards them to its parent after receives data messages from its children. It is important to find an optimal shortest path tree with maximum lifetime and shorter delay but slightly high time complexity and but more suitable for distributed implementation. There is problem into the load balancing scheme at each level of the fat tree and there is communication in between two nodes. If there is a link break in the unipath on the active route then communication also breaks. Le et al.[7] proposed an approach to construct a shortest path tree for each sink and dynamically adjust to balance the load among sinks. These works are based on real systems, but do not provide theoretical insight into maximization of lifetime. Y. Wu et al.[8] considering the energy depletion in transmitting and receiving messages, which are the two major energy consuming operations. Dijun et al.[9] studied the problem of finding an optimal shortest path tree to prolong the lifetime of the network, when in network aggregation is used.

Fig. (viii): Tree Topology

C. Star Topology

Star networks are connected to a centralized communication hub (sink) and the nodes cannot communicate directly with each other. The entire communication must be routed through the centralized hub. Each node is then a “client” while the central hub is the “server or sink” as shown in Fig. 2.3. But there is disadvantage of single path communication. proposed Turbo-Like (TL) codes with two simplified serial message passing algorithms for star- WSN. The two algorithms are implemented based on variable node updating. One is the modified sum-product algorithm (MSPA) and the other is the simplified feedback belief propagation algorithm (S-FBPA), both of proposed algorithms have significant complexity reduction. proposed a new routing method for WSNs to extend network lifetime using a combination of a fuzzy approach and an A-star algorithm. The proposal is to determine an optimal routing path from the source to the destination by favoring the highest remaining battery power, minimum number of hops, and minimum traffic loads. To demonstrate the effectiveness of the proposed method in terms of balancing energy consumption and maximization of network lifetime, we compare our approach with the A-star search algorithm and fuzzy approach using the same routing criteria in two different topographical areas.

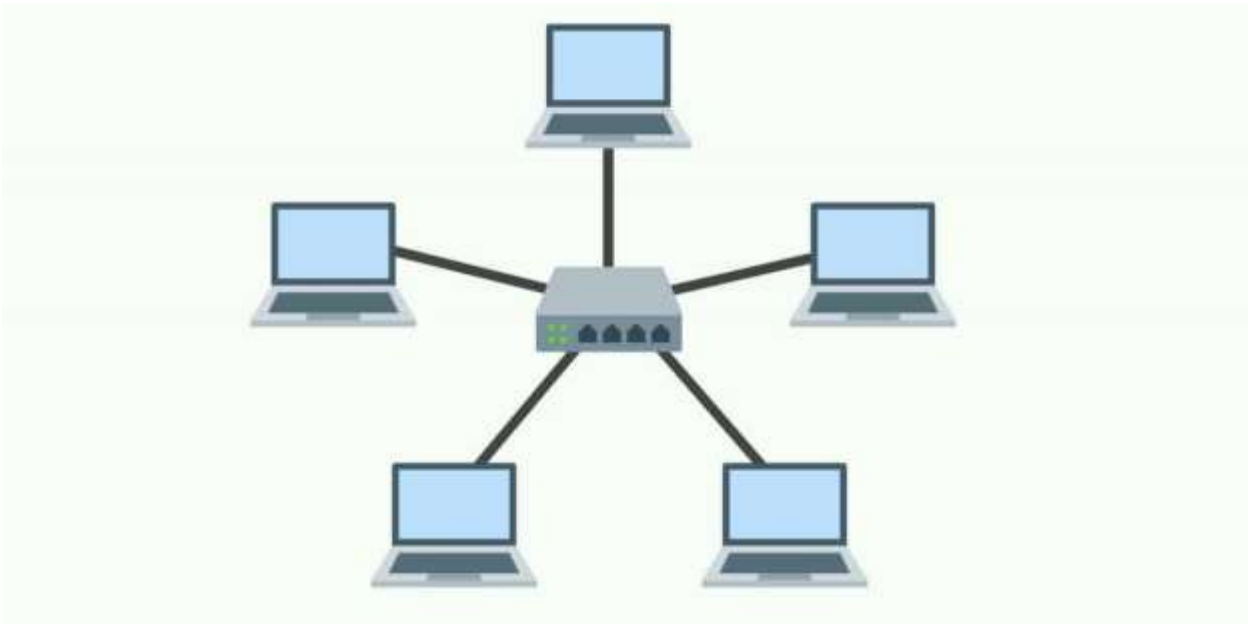


Fig. (ix): Star Topology

D. Ring Topology

In a ring network, every node has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (either "clockwise" or "counterclockwise"). A failure in node breaks the loop and can take down the entire network. but congestion of traffic and double path communication proposed algorithm considers remaining energy when selecting cluster heads and uses multi-round clustering instead of clustering in every round. Algorithm performs better in reducing the energy consumption of nodes and effectively improves the lifetime of WSNs.

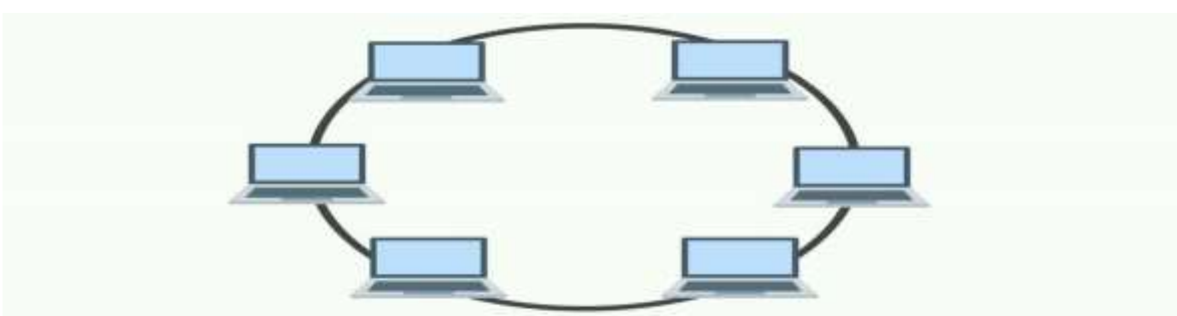


Fig. (x): Ring Topology

E. Mesh Topology

Mesh topologies involve message can take any of several paths from source to destination. (Recall that even in a ring, although two paths exist, messages can only travel in one direction.) A mesh network in which every node connects to every other is called a full mesh and there is partial mesh networks also exist in which some devices (nodes) connect only indirectly to others. Riggio et al.[14] proposed an hybrid mesh/sensor network architecture based on a sharing of tasks between mesh routers and sensor nodes and reduce the network load while preserving data confidentiality and integrity. Thuy et al.[15] proposed a multipath solution for event-driven cluster-based routing in WSN called Energy-Aware Mesh Routing Protocol (EMRP) with main design features: reliable data transmission, load balance and energy efficiency.

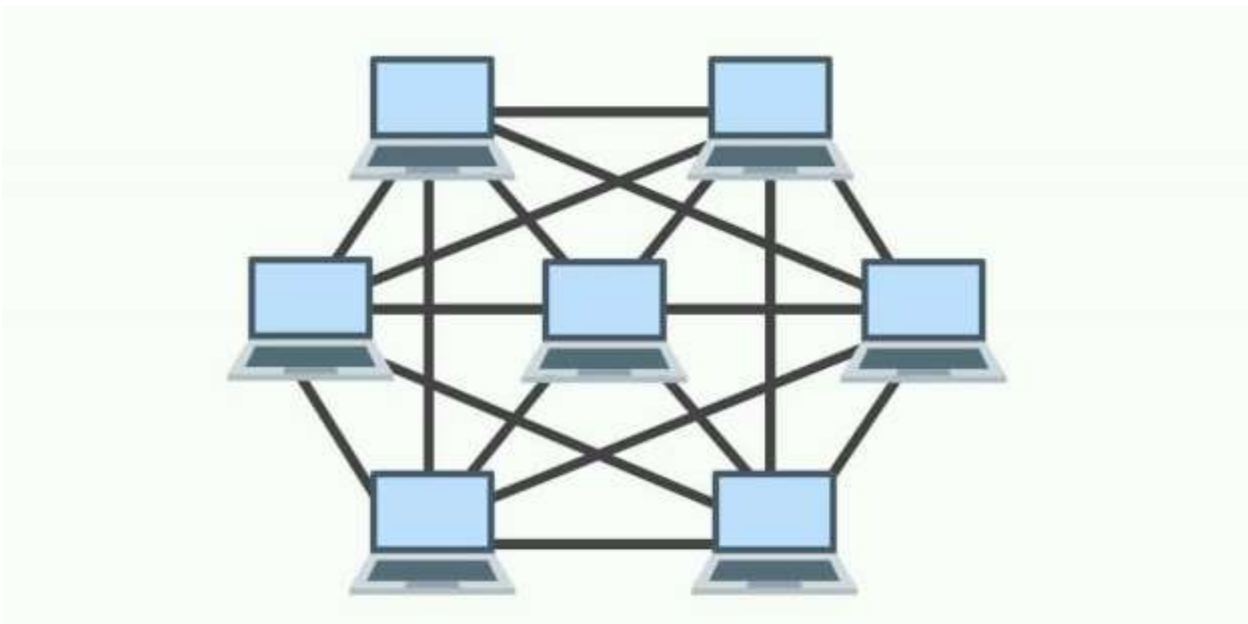


Fig. (xi): Mesh Topology

F. Circular Topology

In this topology, there is a circular sensing area and that the sensing area has a sink (at center). The sensor nodes sense the event of interest and transmit these data to the sink. The nodes are randomly deployed with uniform density all around the sink as shown in Fig.2.6. Depending on the distance of a node from the sink and the transmission range of the nodes, data have to traverse single or multiple hops before being received by the sink. The circular web topology is easy to establish, easy to maintain, and more efficient in this DGRAM is fully self-configuring and slot assignment is done without exchange of any control messages. . It is energy efficient, nodes go through a short beacon exchange phase to learn the location of other nodes. presents an integrated MAC and routing protocol for time sensitive WSN applications and TDMA-based protocol. At particular time slot only some of the nodes are participating for communication, whereas other nodes are in sleep mode. So, it conserves energy. Due to the various time slots, number of collisions at the sink also has been reduced.

Circular topology of this routing algorithm has number of Tiers (Tier1, Tier2, . . ……..). The node which is on the diagonal, follow its original path for communication. Each of these nodes has two possible paths for routing. Depending on the energy level of the path, it selects the path and forwards the packets. It is energy efficient, more packets received at sink.

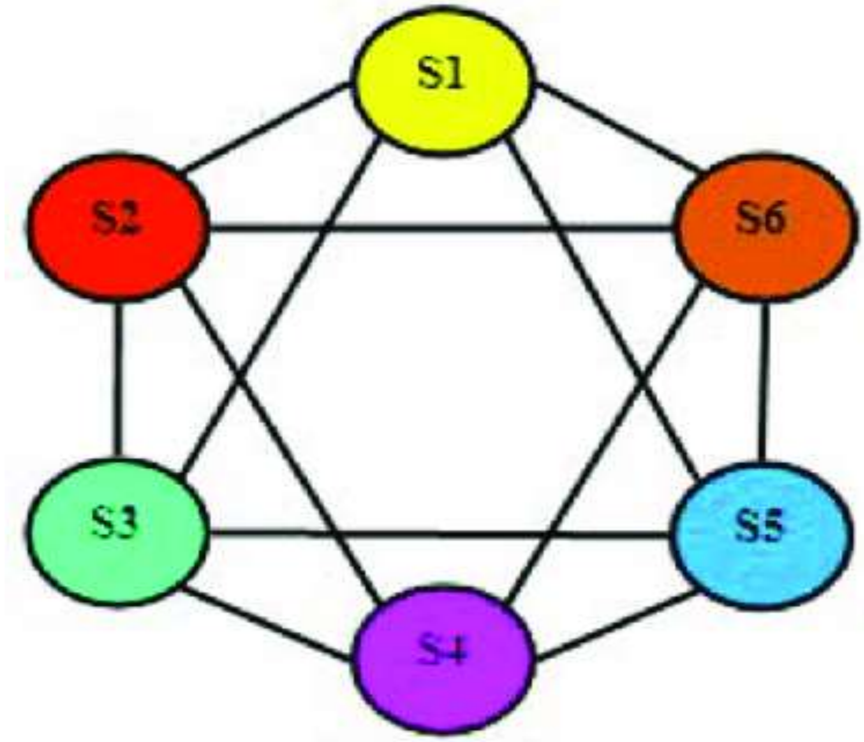


Fig. (xii): Circular Topology

G. Grid Topology

The sensor network field dividing into grids as shown in Fig 2.7. The network area is partitioned into non-overlapping square grid with same size. There should be at least one and only one node in working state in each grid at any time. In order to extend the network life time, the nodes in a grid should work in turn. Inside each grid, one node is selected as a grid head which is responsible for forwarding routing information and transmitting data packets. Routing is performed in a grid-by- grid manner. Grid-based multi-path routing protocol intended to route packets fast, utilize and extend sensor nodes energy in addition to avoiding and handling network congestion when happens in the network. energy dissipation of the cluster nodes, then communicates with BS through a relaying node. This algorithm is useful to reduce node energy consumption and prolonged life of the system also enhanced the load balance of the network. proposed congestion control mechanism in order to relieve the congested areas. This algorithm extend the network lifetime and to utilize the available storage and energy efficient of the network. proposed a joint priority-based algorithm that eliminates congestion and achieves weighted fairness in multipath and multi-hop wireless sensor network. In this paper enhance the lifetime of the network and energy efficient.

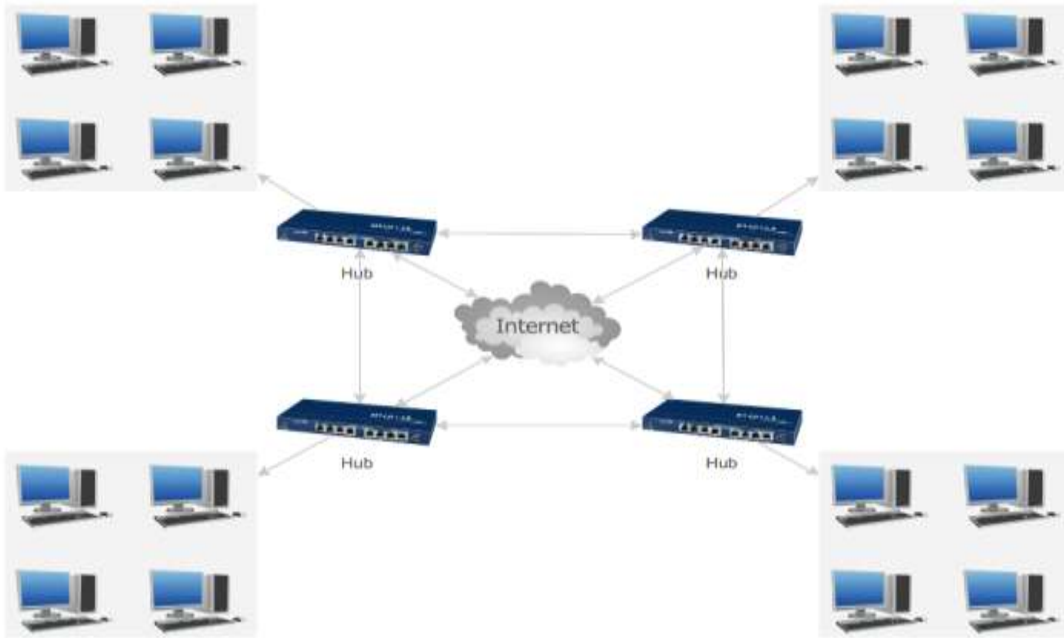


Fig. (xiii): Grid Topology

The objective of this is to route the packets before missing their deadlines with minimum energy consumption. In this section, we discuss related work that handles multi-path routing and congestion control issues in WSNs. From literature survey observed that in the previous section various routing techniques and topologies have been proposed to overcome the problem of delay, congestion in Wireless Sensor Networks. Every technique has its own advantages and disadvantages depending upon the applications. Sensors can be placed anywhere in home, environment etc. to collect the information as sensors have limited battery that is why energy consumption is more important in WSNs.

1.3.1 Physical design:

It is a graphical representation of a system showing the system internal and external entities, and the flows of data in and out of the system. It can be broken into 3 subtasks-

-UI Design: It is concerned with users adding information to the system and how the system

responds to it.

-Process design: It is concerned with how data moves from the system and how it is validated.

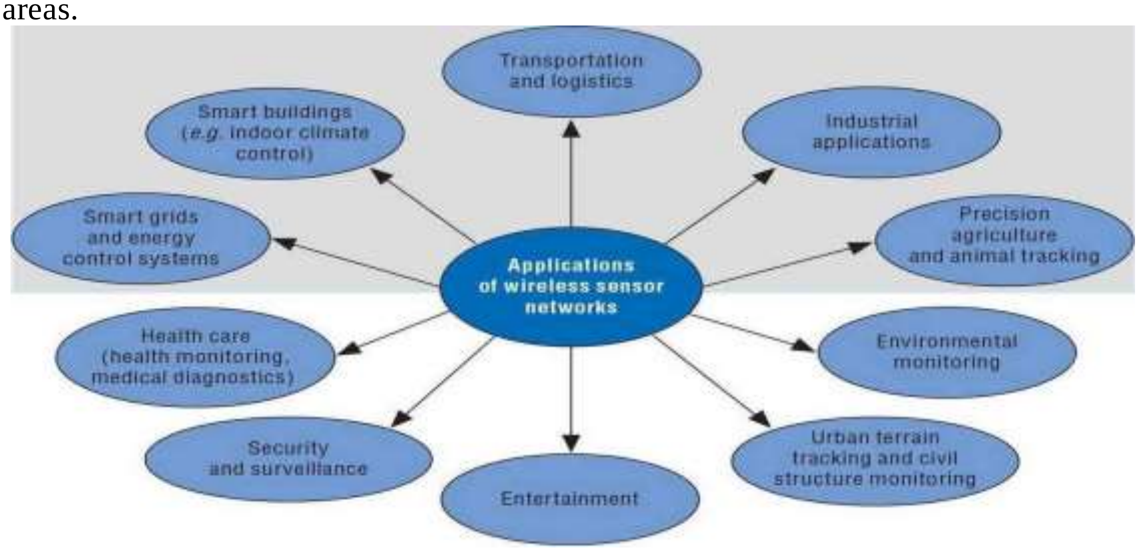
-Data design: It is concerned with how data is represented and stored in the system.

1.3.2 Logical Design:

It pertains to an abstract representation of the data flows, inputs and outputs of the system. It is often conducted via modeling, using a graphical model of the actual system. To represent logical design we can use different diagrams like Entity relationship model.

1.3 Applications of WSN

Wireless sensor networks may comprise of numerous different types of sensors like low sampling rate, seismic, magnetic, thermal, visual, infrared, radar, and acoustic, which are clever to monitor a wide range of ambient situations. Sensor nodes are used for constant sensing, event ID, event detection & local control of actuators. The applications of wireless sensor networks mainly include health, military, environmental, home, & other commercial areas.



Fig(xiv): WSN Application

- Military Applications
- Health Applications
- Environmental Applications(city reconnaissance)
- Home Applications
- Commercial Applications
- Area monitoring
- Health care monitoring

- Environmental/Earth sensings
- Air pollution monitoring
- Forest fire detection
- Landslide detection
- Water quality monitoring
- Industrial monitoring

1.4 Security Issues in Wireless Sensor Networks

If sensor networks are to attain their potential, security is one of the most important aspects to be taken care of. The need for security in military applications is obvious, but even more benign uses, such as home health monitoring, habitat monitoring and sub-surface exploration require confidentiality. WSNs are perfect for detecting environmental, biological, or chemical threats over large scale areas, but maliciously induced false alarms could completely negate value of the system. The widespread deployment of sensor networks is directly related to their security strength.

1.5 WSN design methodology

-First, connect all the connections as per shown in the circuit diagram below.

-Enter the code in Arduino IDE, compile and upload it.

-Then check whether the module is working properly or not.

-If not sort out the errors

Chapter 2 : Literature Review

2.1 It helps us with data on how to connect Wifi module with Arduino Uno

2.2 Algorithm (1) used to control the counter is very important and the logic is provided here.

2.3 Adding libraries for connecting Arduino IDE to software programming(2) is also shown

2.4 Also due to overloading we learnt flashing of memory in

Arduino(3)

2.5 Comparing all the boards(3) and choosing Arduino Uno.

Chapter 3: Problem Statement

A clean environment is nothing short of a necessity. We all know that unclean and filthy surroundings can breed disease-causing microorganisms galore. India has started taking actions to clean the country but still the results are not up to the mark. We need this system to ensure the advancement of cleanliness in the country by encouraging people to use Smart Toilets, E-Dustbin, Public transport having a unique Dustbin mechanism and many more.The involvement of Internet of Things will attract citizens attention which will encourage them to use our systems, which will lead to cleanliness of society. Our website and app will take care whether our systems are working well or not and will inform the Authorized person immediately if anything goes wrong. This will ensure that our systems are well maintained and can be used anytime and anywhere.If there is an issue of sanitation and hygiene in our cities, most of it is contributed by its citizens. What innovative mechanisms can be introduced to make the people more aware about maintaining a better hygiene? Design a system that issues such products to individuals that can educate people about ways to maintain hygiene.

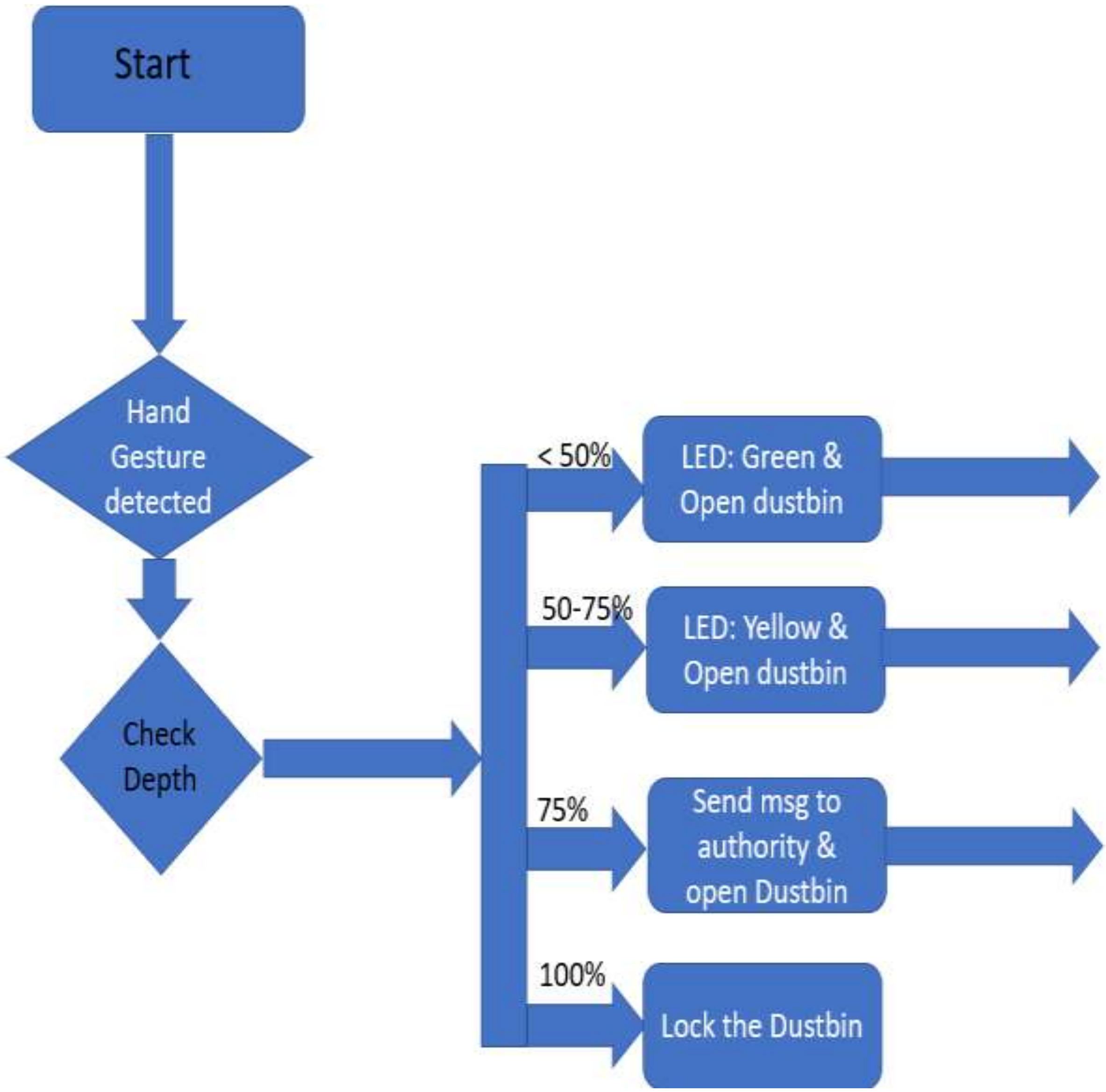
Chapter 4: Objectives

A clean environment is nothing short of a necessity. We all know that unclean and filthy surroundings can breed disease-causing microorganisms galore. India has started taking actions to clean the country but still the results are not up to the mark. We need this system to ensure the advancement of cleanliness in the country by encouraging people to use Smart Toilets, E-Dustbin, Public transport having a unique Dustbin mechanism and many more.The involvement of Internet of Things will attract citizens attention which will encourage them to use our systems, which will lead to cleanliness of society. Our website and app will take care whether our systems are working well or not and will inform the Authorized person immediately if anything goes wrong. This will ensure that our systems are well maintained and can be used anytime and anywhere.

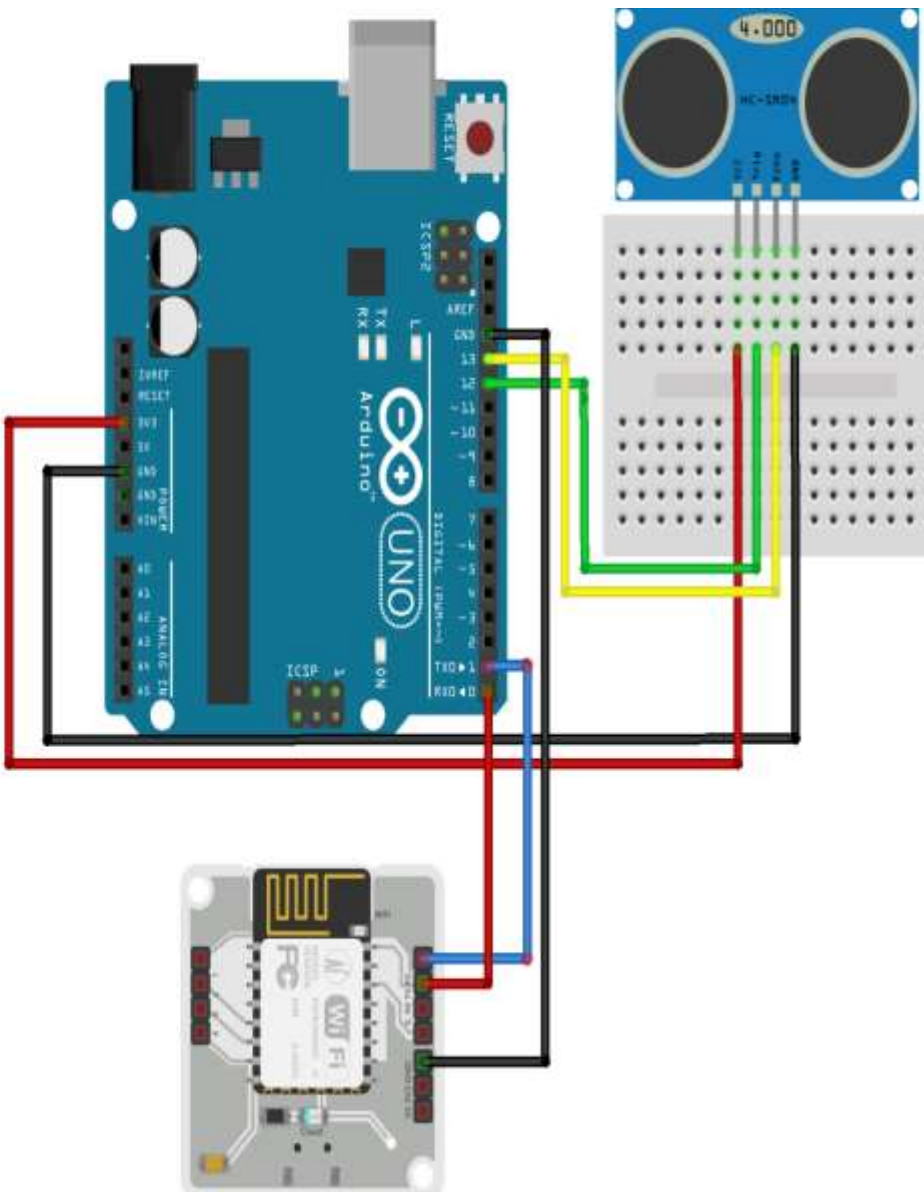
Solution/remedies for E-dustbin :

- Automated lid opening /closing
- Automated messaging system after the bin is full

Chapter 5 : Project Flow



Chapter 6: Circuit Diagram



Chapter 7 :Requirement of Hardware And Software

Hardware Requirements:

1. Arduino Uno
2. GSM module
3. RFID module
4. Ultrasonic Sensor
5. IR Sensor
6. Jumper wires
7. Servo motor
8. Push Buttons
9. LEDs

Software Requirements:

1. Arduino Ide
2. Blynk App

Chapter 8: Implementation

```
#define BLYNK_PRINT SwSerial

#define TRIGGER 6

#define ECHO 7

#include <SoftwareSerial.h>

SoftwareSerial SwSerial(10,11); //RX,TX

#include <BlynkSimpleStream.h>

char auth[] = "dT8IT3taC1QX093m1S5V-TF2d95o-EW_";

BLYNK_WRITE(V5)

{

  int pinValue = param.asInt();

}

void setup() {

  SwSerial.begin(9600);

  Serial.begin(9600);

  Blynk.begin(Serial, auth);

  pinMode(TRIGGER, OUTPUT);

  pinMode(ECHO,INPUT);

  pinMode(9 ,OUTPUT);

  pinMode(10 ,OUTPUT);
```

```
 pinMode(11 ,OUTPUT);


 }
void loop() {
  long duration, distance;
  digitalWrite(TRIGGER, LOW);
  delayMicroseconds(2);
digitalWrite(TRIGGER, HIGH);
  delayMicroseconds(10);
digitalWrite(TRIGGER, LOW);
duration = pulseIn(ECHO, HIGH);
distance = (duration/2) / 29.1;
Blynk.virtualWrite(V5, distance);
 delay(200);
 Blynk.run();
 if (distance >=20 && distance <= 30 ){
 digitalWrite(11 , HIGH);
    }
    else{
      digitalWrite(11 , LOW);
    }
```

```
  if (distance >=10 && distance <= 20 ){
    digitalWrite(10 , HIGH);
  }
  else{
    digitalWrite(10 , LOW);
  }
  if (distance <= 10  ){
    digitalWrite(9 , HIGH);
  }
  else{
    digitalWrite(9 , LOW);
  }


  Serial.print("Distance: ");
  Serial.println(distance);


}
```

CHAPTER 9 : TESTING

TESTING OF PROJECT:

Test Case No.	Test Case	Expected Result	Actual Result	Pass/Fail
1	LED Blinking	Less – green Medium – yellow Full - red	Less – green Medium –yellow Full - red	PASS
2	On full(Dustbin Lock)	Successful	Successful	PASS
3	Wifi Connectivity	Connect to Wifi	Successfully Connected	PASS

STEP1:
Compile and upload the Arduino code in the Arduino Uno board. After uploading is done connect the adapter to the bread board power supply.

STEP2:
Now, when the dustbin is filled 20% green light glows, when the dustbin is filled 50-60% yellow LED glows and when it is completely filled red LED glows. Once completely filled the dustbin door is closed shut, Notification is send to the BMC and only the authorized person having the RFID will be able to open.

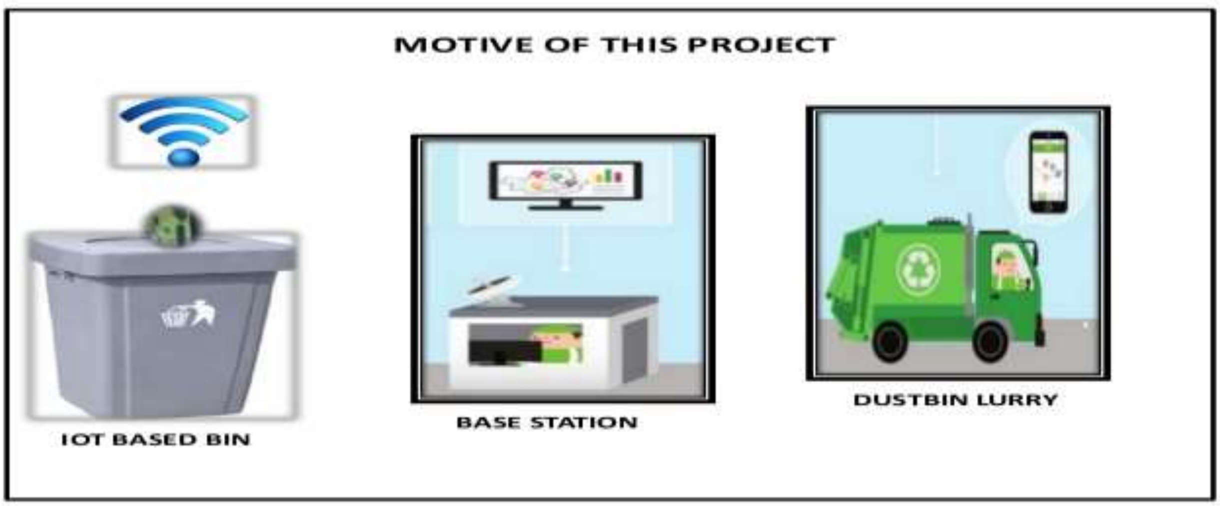


Fig. (xv)

STEP3:

The Notification will be displayed on the Blynk Application.

Fig. (xvi)

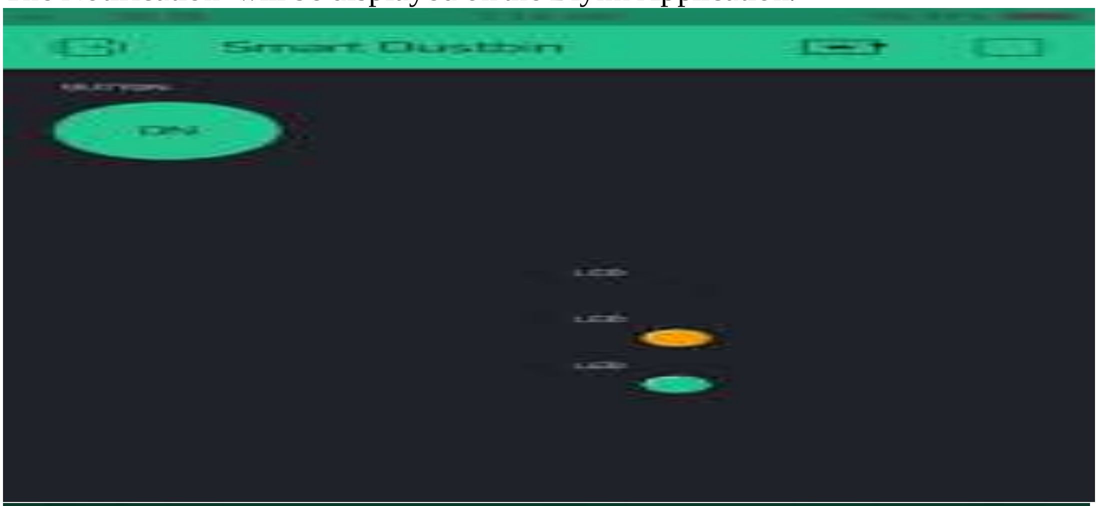
Fig. (xvii)

STEP5:

Also a message will be sent on your connected devices stating the wifi connected successfully.

CHAPTER 10 : RESULT

The Notification will be displayed on the Blynk Application.



Chapter 11: Conclusion

A clean environment is nothing short of a necessity. We all know that unclean and filthy surroundings can breed disease-causing microorganisms galore. India has started taking actions to clean the country but still the results are not up to the mark. We need this system to ensure the advancement of cleanliness in the country by encouraging people to use E-Dustbin having a unique Dustbin mechanism and many more. There are no E-Dustbins available in India. Our E-Dustbin will inform the Authorized person when to pick the garbage. This will ensure efficiency of maintaining the surrounding clean.

E-dustbin:

- Automatic motion detection
- Sewage overflow control
- Cost efficient
- Monitors garbage bin and informs about the level of garbage bin

Chapter 12: References

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Chapter 13: Reference Papers

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[3] https://www.ijert.org/research/iot-based-smart-garbage-monitoring-system-IJERTCONV6IS13087.pdf