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CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

1.1 PREAMBLE

The Smart City aims to make optimal and sustainable use of all resources, while maintaining an appropriate balance between social, environmental and economic costs. The wireless sensors are attached to street lamp, water tank, parking area and dustbin. Sensors are then attached to Arduino micro controller board where each and every necessary parameters for city are monitored and updated to cloud by PC.

Sensors are connected to the internet and the information from the sensors is gathered at a server through the internet. Security and manageability of sensors, information transmission connecting to the internet relentlessly with low cost and high scalability are expected.

The main concept of IOT is machine to machine communication. Internet-based sensor networks have recently been gaining attention. Sensors are connected to the Internet and the information from the sensors is gathered at a server through the Internet**.** The cloud is connected with Blynk server in turn which is connected to build in Blynk application of user's Android phone.

In this a system of interconnected smart modules is developed where each and every parameter necessary for a city is monitored and updated to the cloud. The project aims at developing a system which facilitates aids in collection of data with the help of interconnected modules consisting of multiple sensors useful for smart city monitoring.

.2 MOTIVATION

A smart city should provide an urban environment that delivers a high quality of life to residents while also generating economic growth. This means delivering a suite of joined-up services to citizens with reduced infrastructure costs.

This becomes increasingly important in the light of the future population growth in urban areas, where more efficient use of infrastructure and assets will be required. Smart city services and applications will allow for these improvements which will lead to a higher quality of life for citizens.

As the population increase the waste dumping and parking space issue will go on increasing.
To maintain the clean and nice environment new innovations are needed.

1.3 EXISTING SYSTEM

1. The main problems of the existing waste collection process and management are as follows:

   - More complications in the processing.

     Many controlling units linked with each other

   - Higher implementation cost.

2. The existing parking management systems require human efforts, and manual recording in excel sheets and on-paper. For huge parking scenario it is a bit hectic to keep track.

1.4 PROBLEM STATEMENT

As we have seen number of times the dustbins are getting overflown and concern person don't get the information within time and due to which unsanitary condition formed in the surrounding, at the same time bad smell spread out due to the waste also it look bad for the city also spreads the harmful diseases around the locality.

In the modern society, there is an ever-increasing number of vehicles. This is leading to problems such as large urban parking lots becoming inefficient, increasing difficulty to find open spaces in busy parking lots, as well as the increasing need to devote larger areas of land for additional parking spaces.

1.5 PROPOSED SYSTEM

The main categories that define smart cities include the quality of the environment Smart parking system, Garbage management & so on.

To improve the quality of life of people by enabling local area development and harnessing technology, especially technology which leads to the smart city.

1.6 SCOPE OF THE PROJECT

- IOT devises/ model can be used for management of parking areas, surveillance of illegally parked vehicles and also the waste management.
- It can be used to control the traffic, waste management and many other issues with easy steps and with less cost.

1.7 OBJECTIVES

- In the approach to the Smart Cities using IOTs, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions.
- Robust IT connectivity and digitalization.
- Safety and security of citizens, particularly women, children and the elderly.
- Sanitation including solid waste management.
- Provide decent and clean environment for all the citizens.

CHAPTER 2 LITERATURE SURVEY

CHAPTER 2

LITERATURE SURVEY

2.1 RESEARCH PAPER

2.1.1: Smart City Development: Smart cities concept and challenges bases for the assessment of ASCIMER.

Publication- Andres Monzon, International Conference on Smart Cities and Green ICT Systems International Conference on Vehicle Technology and Intelligent Transport

Systems, Coimbatore, India, 14-17 September 2019,IEEE Xplore, 24 December 2019, DOI:10.1007/978-3-319-27753-0_2

Methodology-Applying European and International Experience to the Mediterranean Region. The objective of this first Work Package of research was the development of the Smart City concept and the identification of the main urban development priorities with a special focus on the Mediterranean area.

Limitation of this paper is that

Gaps identified in this paper is that Low urban institutional capacities. Shortage in access to technology. Economy weaknesses and lack of competitiveness

2.1.2: Intelligent Development of Smart Cities: Deepint.net Case Studies.

Publication- Sustainable Smart Cities and Territories

Methodology- Deepint.net is a platform that has been designed to use Artificial Intelligence models for the analysis of datasets and real-time data sources, all without programming Limitation is that read any type of data from webs, files, databases, sensors, it can also stream data in real time if needed.

Gaps which are identified here is that presents an efficient hyper physical platform for the smart management of smart cities.

2.1.3: Machine Learning in Wireless Sensor Networks for Smart Cities: A Survey.

Publication- 3rd International Conference on Computer Science and Computational Intelligence, 10.1016/j.procs.2018.08.168,2018

Methodology which is used here are as follows: The small size IoT nodes based on low power Bluetooth (IEEE 802.15.1) standard and wireless sensor networks (WSN) (IEEE 802.15.4) standard are generally used for transmission of data to a remote location using gateways. The WSN based IoT (WSN-IoT) design problems include network coverage and connectivity issues, energy consumption, bandwidth requirement, network lifetime maximization, communication protocols and state of the art infrastructure The Limitation is that Use of AI & ML is used which needs proper prior datasets.

Gaps which are identified here is that The supervised learning algorithms have been most widely used (61%) as compared to reinforcement learning (27%) and unsupervised learning (12%) for smart city applications.

2.1.4: Deep learning application in smart cities: recent development, taxonomy, challenges and research prospects.

Publication- Expert Systems with Applications, 136. 10.1016/j.eswa.2019.06.036,2019

Methodology which is used Applying European and International Experience to the Mediterranean Region". The objective of this first Work Package of research was the development of the Smart City concept and the identification of the main urban development priorities with a special focus on the Mediterranean area.

The Limitation is that

Gaps which are identified here is that despite raise in popularity and achievements made by deep learning in solving problems in smart cities, no survey has been dedicated mainly on the application of deep learning in smart cities to show recent progress and direction for future development.

2.1.5: An Analysis of Design-Reality Gap in Smart city Building: the Case of Ho Chi Minh City.

Publication- 6th International Conference on Communication and Electronics Systems,978-1-6654-3587-1/21/$31.00,2021

Methodology used here is the study adopts the framework of six dimensions developed by Manville which are considered to be more holistic and inclusive. This framework has been combined various early studies on smart city. The six dimensions include: smart governance, smart economy, smart mobility, smart environment, smart people, and smart living.

Limitation is that the implementation can be met with a number of challenges which need to be overcome.

Gaps Identified here is that Strategy, Technology, Organization, People, and Environment

2.1.6: Intelligent Development of Smart Cities: Deepint.net Case Studies.

Publication- Science direct,0141-9331/© 2021 Elsevier B.V.

Methodology- Deepint.net is a platform that has been designed to use Artificial Intelligence models for the analysis of datasets and real-time data sources, all without programming.

Limitation read any type of data from webs, files, databases, sensors, it can also stream data in real time if needed.

Gaps Identified here is that presents an efficient hyperphysical platform for the smart management of smart cities

2.1.7: Survey on Automatic devices Segmentation Techniques on IOT devices.

Publication- International Conference on Information Management and Technology 2020,

Doi: 10.1109/ICIMTech50083.2020.9211173

Methodology- Region growing method, Hybrid segmentation

Limitation of this method is that its tough to manage and control for the normal people. Gaps Identified in this paper is that some techniques are not robust, considering the characteristics like accuracy and performance.

2.1.8: Real- time smart garbage bin mechanism for solid waste management in smart Cities.

Publication- SIP (2019), Volume: 08, e16

Methodology- Accesses real-time information of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean.

Gaps Identified in this paper is that inaccessibility to actual data required, lack of throughput, and late unloading.

2.1.9: Understanding and personalizing smart city services using machine learning, The Internet-of-Things and Big Data.

Publication- Jeannette Chin; Vic Callaghan; Ivan Lam, 2017 IEEE 26th International Symposium on Industrial Electronics (ISIE), Edinburgh, UK, DOI: 10.1109/ISIE.2017.8001570

Limitation here is that the system still does not exist within Honduras, but work continues to develop this system and create a local test platform

Gaps Identified in this paper is Here the water level is considered for the large areas but the estimation is failed.

2.1.10: IOT based Parking Solutions.

Publication - **Irina Sidorenko -**December 27, 2019

Methodology- Smart parking utilizes smartphones and other sensing devices to ascertain the occupancy of a parking structure or level. It's accomplished through the use of cameras, counting utilities at the entrances or gates of parking structures, sensors embedded in the pavement of individual parking spaces, etc

Limitation of this method is assistant services like Siri, Cortana, and Alexa, it's not hard to imagine having such an assistant within a vehicle's onboard computer to help with tasks like locating parking spaces. .

Gaps Identified here is it concentrates on object detection in images and not real time Object Detection.

2.1.11: Towards Smart Parking Management System for Smart Cities.

Publication- 2019 IEEE International Smart Cities Conference (ISC2)

Methodology- The aim of the Smart Parking Management System (SPMS) proposed in this paper is to assist drivers in alleviating several issues linked to parking. Our SPMS provides a sensing platform supported by a mobile app to enable real-time interaction of drivers with the car park infrastructure in a way that minimizes drivers' search time for an empty parking spot within large multi-story car parks and facilitates the localization of their parked cars. Gaps Identified in this paper is that some techniques are not robust, considering the characteristics like accuracy and performance.

2.1.12: **Smart Parking Management System.**

Publication- 2019 5th International Conference On Computing, Communication, Control And Automation (ICCUBEA).

Methodology- Using REST based framework the system becomes loosely coupled from underlying architecture. The paper is organized as follows - section I contains introduction to our system, section II lists user side modules and parking lot management side modules one by one, section III contains traffic prediction module in greater depth focusing on technical implementation.

Limitation of this method is that is has more objectives to go through and implementing it may be difficult.

Gaps Identified here is that the proposed is so huge to implement for some government.

2.1.13: IOT based Waste Management System

Publication- 2022 International Conference on Electronics and Renewable Systems (ICEARS)

Methodology- This system is implemented using Arduino microcontroller, which controls the entire process with ease and simplicity. This segregator system consists of various stages including of infrared sensor, inductive proximity sensor, rain drop sensor, photoelectric sensor, and the segregation bins. Each waste is detected by the relevant sensor and drops into

the bins allocated to it for further processing. The status of the segregated data is made available in the cloud for monitoring and controlling purposes. These enabled policies empower cities to manage waste collection effectively.

2.1.14: Real- time smart garbage bin mechanism for solid waste management in smart Cities.

Publication- SIP (2019), Volume: 08, e16

Methodology- Accesses real-time information of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean.

Gaps Identified in this paper is that inaccessibility to actual data required, lack of throughput, and late unloading.

2.1.15: An Early Flood Detection System Using Mobile Devices

Publication- International Journal of Engineering Applied Sciences and Technology, 2021 Vol. 5, Issue 11, ISSN No. 2455-2143.

Methodology - The system intends to examine the already available waste management system and collect the data to create more optimism waste management system. The system not only notifies the trash level but also alerts the person working on it. It will help the Municipal corporations, Government organization also individuals who till date use manual ways for collecting garbage from dustbins. It also aims at minimizing the process time and the interference of humans in the processes

Limitation of this method is that they have proposed that they are using the Moisture Sensor Which only works when they is proper management of dustbin else the accuracy will be less.

Gaps Identified here is that some techniques are not robust, considering the characteristics like accuracy and performance.

2.1.17: Survey on Automatic devices Segmentation Techniques on IOT devices.

Publication- International Conference on Information Management and Technology 2020, Doi: 10.1109/ICIMTech50083.2020.9211173

Methodology- Region growing method, Hybrid segmentation

Limitation of this method is that it's tough to manage and control for the normal people. Gaps Identified in this paper is that some techniques are not robust, considering the characteristics like accuracy and performance.

2.1.18: Deep learning application in smart cities: recent development, taxonomy, challenges and research prospects.

Publication- Expert Systems with Applications, 136. 10.1016/j.eswa.2019.06.036,2019

Methodology which is used Applying European and International Experience to the Mediterranean Region". The objective of this first Work Package of research was the development of the Smart City concept and the identification of the main urban development priorities with a special focus on the Mediterranean area.

The Limitation is that

Gaps which are identified here is that despite raise in popularity and achievements made by deep learning in solving problems in smart cities, no survey has been dedicated mainly on the application of deep learning in smart cities to show recent progress and direction for future development

2.1.19: Real- time smart garbage bin mechanism for solid waste management in smart Cities.

Publication- International Conference on Information Management and Technology 2020, SIP (2019), Volume: 08, e16

Methodology- Accesses real-time information of any smart garbage bin deployed across the city and helps to resolve the problem of waste overflow from garbage bins and keep the smart cities clean.

Gaps Identified in this paper is that inaccessibility to actual data required, lack of throughput, and late unloading.

2.1.20: Machine Learning in Wireless Sensor Networks for Smart Cities: A Survey.

Publication- 3rd International Conference on Computer Science and Computational Intelligence, 10.1016/j.procs.2018.08.168,2018

Methodology which is used here are as follows: The small size IoT nodes based on low power Bluetooth (IEEE 802.15.1) standard and wireless sensor networks (WSN) (IEEE 802.15.4) standard are generally used for transmission of data to a remote location using gateways. The

WSN based IoT (WSN-IoT) design problems include network coverage and connectivity issues, energy consumption, bandwidth requirement, network lifetime maximization, communication protocols and state of the art infrastructure The Limitation is that Use of AI & ML is used which needs proper prior datasets.

Gaps which are identified here is that The supervised learning algorithms have been most widely used (61%) as compared to reinforcement learning (27%) and unsupervised learning (12%) for smart city applications.

2.3 PATENT SEARCH

2.3.1: Landfill waste management process

AUTHOR - Stanley M. Kozak.

INNOVATIVE IDEA- A process for reducing waste material for use with household and other landfill waste material at a landfill waste management site is described. The process reduces the volume of waste material in the landfill site, prevents contamination of the ground soil, allows for the natural breakdown of the organic components of the waste material and allows for the recycling of some or all of the waste material.

LIMITATIONS-

This method of simply burying the waste material under a layer of earth does not lead to the natural breakdown of the organic component of the waste.

GAPS IDENTIFIED- This method has no prior plan and its very difficult to manage huge waste at a time.The waste materials are collected and transported by truck or barge to a landfill site. Once at the landfill site, the waste materials may be segregated somewhat to remove large metal objects, concrete and the like from the rest of the material. The remainder of the waste material is then usually simply covered over with earth and buried. In some locations, where burning is allowed, those items which may be burned are and the rest of the waste material is buried.

2.3.2: Parking space notification device and method.

AUTHORS- Nac Dong Kim

INNOVATIVE IDEA- The present invention relates to a parking space notification device and method, and more particularly, to a parking space notification device and method for continuously checking a parking space using leaving or entering information of a vehicle after searching for the parking space.

LIMITATIONS- It involves the image sensors may be one or more sensors selected from among cameras, radars, and light detection and ranging (LIDAR) sensors these type of sensors are costly and managing/controlling these are little tough.

CHAPTER 3

SYSTEM REQUIREMENT SPECIFICATIONS

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 Non-Functional Requirements:

- Usability: The models should be able to detect the required objects independent different Position, Shape and Size, Colour, Fonts, of the Number plate.
- Reliability: The software should be capable of being trained with large datasets, without failure for a given period.
- Performance: The system should be consistently responsive and with a good performance (i.e., higher fps).
- Efficiency: The system should detect the object and classify it accurately.

3.2 Software Requirements:

- Blynk Server -
    - It is responsible for forwarding the messages between Blynk mobile application and various microcontroller boards and SBCs.

3.3 Hardware Requirements:

I. ESP controller

II. IR sensors

III. Float switch

IV. Wi-Fi

V. lads

VI. Android smart phone

VII. LDR sensor

VIII. Water plate sensor

IX. 5V Battery

X. DSP

3.4 System Requirements:

 Arduino IDE

Embedded C

CHAPTER 4

DESIGN AND IMPLEMENTATION

CHAPTER 4

4.1 SYSTEM ARCHITECTURE

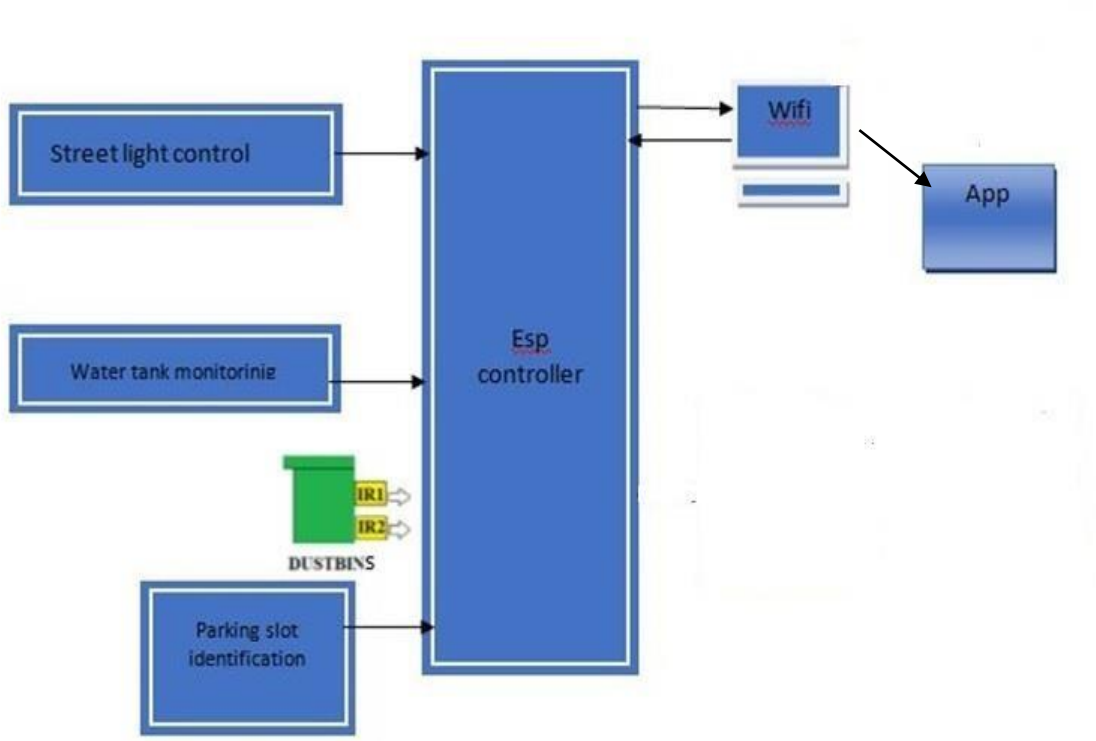

Fig 4.1.1: System Architecture

Flow of the program:

1. Sensors will detect the signals.
2. The signals are sent to the microcontroller and then the processing is done.

3. The processing is done on the threshold value set and based on that the final result is out given.

4. The message is then transmitted through Wi-Fi model to the Blink server.

5. The message can be read on the mobile application.

4.2 ACTIVITY DIAGRAM

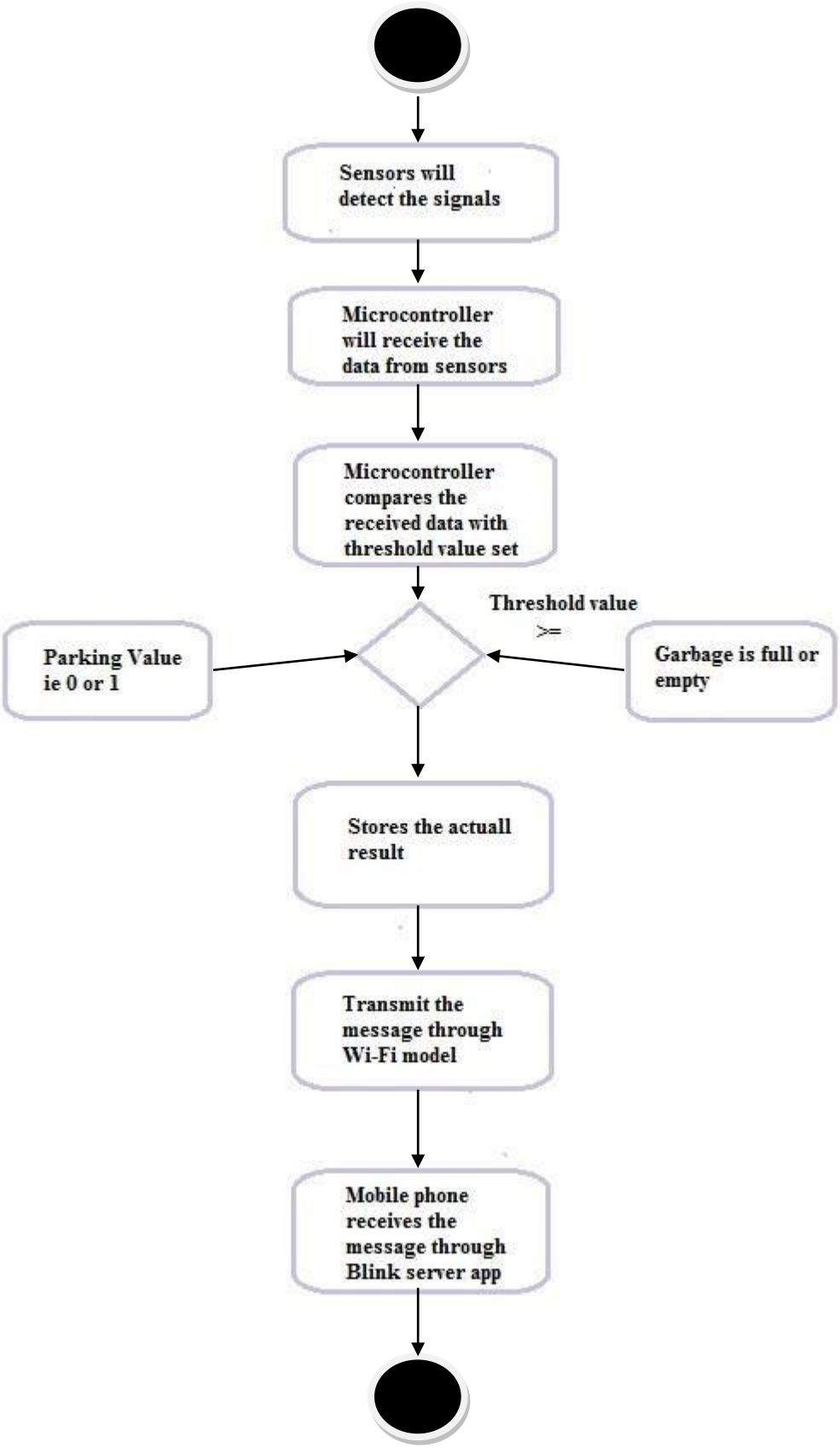

Fig 4.2.1: Activity Diagram

4.3 METHODOLOGY

I. Here various wireless sensors are used for monitoring various parameters like Garbage management, Parking System.

II. In this system of interconnected smart modules is developed where each and every parameter necessary for a city is monitored and updated to the cloud.

III. Two IR sensors are used for monitoring.

IV. The values are then send to the cloud through Wi-fi connection.

a. Smart Parking system is a dynamic management system of pricing for parking slots. Every parking has a ranking, indicating the 'value' of the parking.

V. Given the location, date and time and the customer details, the system will provide the relevant parking slots available for parking, and it costs. The system will present a mapping of the parking slots, so the consumer can easily select the desired slot.

VI. Normally there is one of the most challenging issues - municipal waste-collection within the Smart City. To optimize the logistic procedure of waste collection, this system can be a prototype. The level of garbage in the dustbin is monitored by real time data.

VII. Two sensors are used. An ultrasonic sensor to determine the level of garbage in the container, and an MQ2 sensor to detect hazardous waste. For the database, we have used Firebase as it was most the suited to connect to multiple sensors and the Android app.

4.4 IMPLEMENTATION

MODELS

The model used is Arduino which is the simplest model, IR sensors will sense & will send the signal to the ESP controller, which then is stored in the database, then through app we can access that.

4.4.1: Input Pins and Wi-Fi model:

- This is the first module of our project.
- This module is developed to provide a simple frontend for the application.
- Frontend comprises all the pins to be defined and also to the Wi-Fi and its username, password.
- Setup all the sensors as shown in the code snippet using pinMode.

```
#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

#include <BlynkSimpleEsp32.h>
#include <LiquidCrystal_I2C.h>
LiquidCrystal_I2C lcd(0x27,16,2);

#define echoPin 18 //echo
#define trigPin 19 //trig
#define ldr 4 //ldr
#define wSensor 2 //water sensor
#define pir1 27 //Parking 1 IR
#define pir2 14 //Parking 2 IR

long duration;
int distance;

char auth[] = "Av-O3r0Q4YBDKiVEknB-FQ5E7J__SXOV";
char ssid[] = "door";
char pass[] = "12345678";

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  pinMode(ldr, INPUT);
  pinMode(5, OUTPUT); //Street Light
  pinMode(15, OUTPUT); //PUMP
  pinMode(wSensor, OUTPUT);
  pinMode(pir1, INPUT);
  pinMode(pir2, INPUT);
```

Fig 4.4.1: Define pins and Wi-Fi code snippet

4.4.2: Setting the Ultrasonic sensor:

- With the loop we have to set the trigger pin to Low / High with delay time of microsecond.
- The ultrasonic works on the base of the object moving towards it, so set the distance for all the possibilities i.e. dustbin is full / empty/ partially filled.
- The given result are printed on lcd display.

```
void loop() {

  Blynk.run();
  //ULTRASONIC
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2) ;
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH);
  distance = duration * 0.034 / 2;
  //level = (distance / 15) * 100;
  lcd.setCursor(0,0);
  Serial.println(distance);

  //DUSTBIN
  if (distance < 4) {
    //lcd.clear();
    lcd.print("Dustbin is full");Blynk.virtualWrite(V0, "Dustbin is full");}
  else if (distance >=14) {
    //lcd.clear();
    lcd.print("Dustbin is Empty"); Blynk.virtualWrite(V0, "Dustbin is Empty");}
  else{
    //lcd.clear();
    //Serial.println(level);
    //val = String((float)level) + " % Filled";
   // Serial.println(val);
   Blynk.virtualWrite(V0, "Partially Filled");
    lcd.print("Partially Filled");
  }
```

Fig 4.4.2: Ultrasonic code snippet (Dustbin)

4.4.3: Parking management:

- With the space digital reading, if the space is equal to 0 or 1 it will show whether the car is parked or not.
- The IR sensors work on the light & object movement.
- It calculates on the bases of the movement of the objects towards it or away from it.
- The resulting message is displayed on lcd display, as well as transmitted to the Blink server through the help of Wi-Fi model.

```
//parking
int space1 = digitalRead(pir1);
int space2 = digitalRead(pir2);
if (space1 == 0)
{

  lcd.setCursor(0,1);
  lcd.print("P1Empty");
  Blynk.virtualWrite(V1, "Parking lot 1 Empty");
  }
else {
  lcd.setCursor(0,1);
lcd.print("P1 Full ");
Blynk.virtualWrite(V1, "Parking lot 1 full");}

  if (space2 == 0){
    lcd.setCursor(8,1);
    lcd.print("P2Empty");
    Blynk.virtualWrite(V2, "Parking lot 2 Empty");}
else {
  lcd.setCursor(8,1);
  lcd.print("P2 Full ");
  Blynk.virtualWrite(V2, "Parking lot 2 Full");}

}
```

Fig 4.4.3: IR code snippet (Parking)

4.4.4: LDR & Water Plates:

- LDR – It work on whether the light is there or not. If there is sunlight it automatically off the light, if the sunlight is not their then it automatically turns the light on.
- Wsensor – it is the water sensor, it work when the water level is low, if water level is high it will no pump the water.
- The level of water is to be set during the installation process only.

```
//LDR
int light = digitalRead(ldr);
//Serial.println(light);
if (light == 1) {digitalWrite(5, HIGH);}// 5 Street Light pin
else {digitalWrite(5,LOW);}

//PUMP
int water = digitalRead(wSensor);
Serial.println(water);
if(water == 1){ digitalWrite(15,HIGH);} // 15 Pump pin
else {digitalWrite(15,LOW);}
```

Fig 4.4.3: LDR and PUMP code snippet (Parking)

4.5 ACTIVATION FUNCTIONS

- The activation function used as input with 5v battery and a centralized micro controller Arduino connected to the internet interface.
- IR sensor mounted on the dustbin activates when it reaches the certain level.
- IR sensors in parking will be activated when there is free lot available in the parking lot, else it will show there is no lot available.

CHAPTER 5

RESULTS AND DISCUSSION

CHAPTER 5

RESULTS AND DISCUSSION

- The project developed has yielded the below shown results. The results are classified based on different types of sensors used. The different types of sensors that were present are: IR sensors (Parking Management), Ultrasonic sensors (Dustin Management), also further enhancement like LDR (Street Light Management) and Wsensor (Water Management).
- Since the project involves comparison of different types of sensors for the existing problem statement, the results is shown in the Blink server app which is installed on the smart phone with includes the below columns:

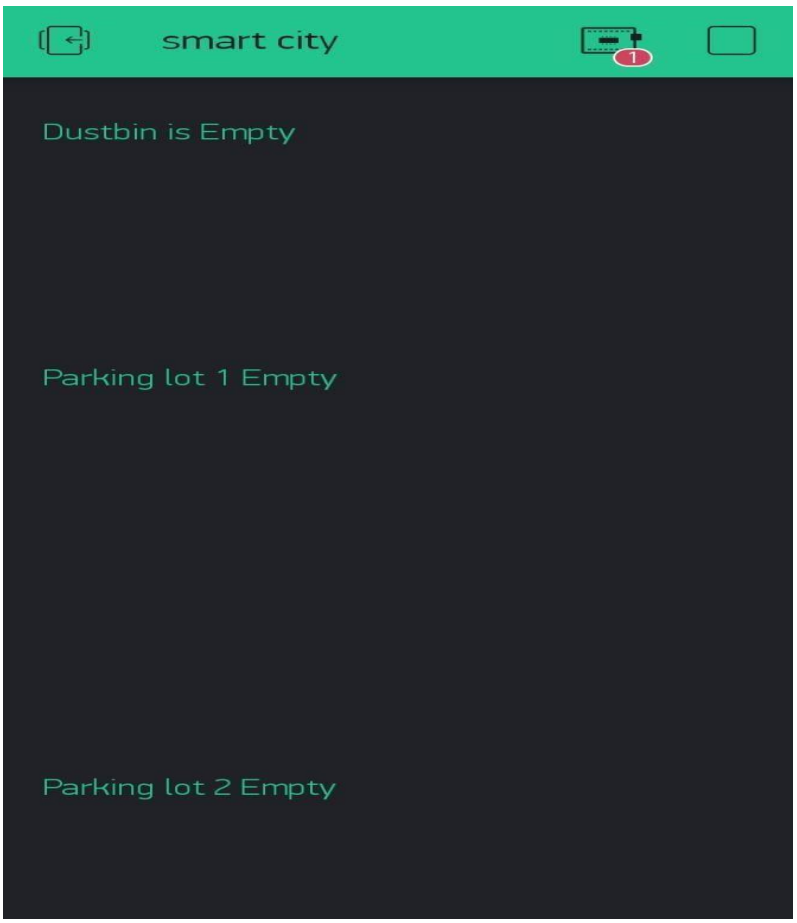

Fig 5.1: Display of Blink Server App

DISCUSSION

Alongside the IOT solutions, smart cities also use technologies including:

- Application Programming Interfaces (APIs)
- Artificial Intelligence (AI)
- Cloud Computing Services
- Dashboards
- Machine Learning
- Machine-to-Machine Communications
- Mesh Networks

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENT

6.1 CONCLUSION

- IOT is setting off an upsurge of information industry.
- IOT is still in its initial stage.
- The hardware of a low-cost module used in IOT enabled systems has been designed and the concept for the use of this module for rural development Smart City Monitoring and controlling is done.

6.2 FUTURE ENHANCEMENT

- Controlling the Traffic Signal lights be another feature that we could look in future.
- Depending on the amount of traffic in a particular direction, necessary controlling actions could be taken.

  Also emergency vehicles and VIP convoys can be passed/moved efficiently.
- Controlling the street light & smart water management will be the other features that we are implementing in future.
- We hope that these advancements can make this system completely robust and totally reliable in all aspects.

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