SMART CITY USING IOT

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ABSTRACT

According to the United Nations Population Fund, in 2019, 54% of the world's population lived in urban areas, approximately 3.3 billion people. By 2030, roughly 66%, or 5 billion people will live in urban areas1. This not only represents a massive challenge in how we build and manage cities but a significant opportunity to improve the lives of billions of people. Rising to that challenge, engineers worldwide are turning to new technology - such as the Cyber Physical Systems, 5G and data analytics Emphasis is given on how sensing and communication technologies of IOT can effectively be used in smart city monitoring. Basically the system consists of a Arduino microcontroller interfaced with many sensors for making the city smarter. The project aims to bring smartness in five different aspects of any city such as density based traffic monitoring, smart garbage management, city pollution control, intensity based street light monitoring and digital water supply system, traffic control system. Further this project also includes controlling of some parameters like water and light.
IOT deals with intricate systems that integrates multiple disperse components towards their synergetic use. In this paper a system of interconnected smart modules is developed where each and every parameter necessary for a city is monitored and updated to the cloud. Emphasis is given on how sensing and communication technologies of IOT can effectively be used in smart city monitoring. This paper also includes smart parking system with garbage collection. Further this project also includes controlling of some parameters like water and light.

Keyword *IoT, 5G, Smart parking, data analytics*

1. INTRODUCTION

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. Security and manageability of sensor information transmission and deployability of sensors connecting to the Internet wirelessly are the major issues though low cost and high scalability are expected. Currently IOT systems are used to remotely record and keep track of family and friends, send notifications about climate change, inform users of traffic information concerning minor, local roadways, notify of arrival and departure times of railways, etc. Smart city refers to a future city that makes use of upcoming and latest technology. The sensors and actuators available in the market today allow users to perform many tasks. Thus, localized or private information of such day to day activities must be securely saved say on a server for keeping track of safety and well-being of humans.

This project work aims at developing a system which facilitates aids in the collection of data with the help of interconnected modules consisting of multiple sensors useful for smart city monitoring. The internet of Things (IoT) is one of the most promising emerging domain that allows objects of regular day to day existence to be outfitted with microcontrollers, handsets for digital communication, and reasonable protocol stacks that will make them ready to speak with the users, turning into a vital part of the internet. IoT idea is deployed for making the Internet to be increasingly vivid and inescapable. This discovers the application in a wide range of spaces, for example, home automation, industrial automation, restorative guides, portable social insurance, old help, smart matrices, car, traffic the board, and numerous others. The initial move will be towards turning into a smart city with vital dimension. Principle fields of activity in this setting are vitality, mobility, the earth, the economy, society, politics, organization what's more, quality of life [14]. A portion of the above are interwoven and progressively connected with the help of IT. Specialized, monetary and social developments give the establishment to such activities.

Smart cities expand on sustainability yet in addition on flexibility as in cities as frameworks are made increasingly safe and versatile to impacts from all around. The IOT thus helps us to design a proper smartly working city with efficient use of various sources of energy preventing wastage of electricity in the public areas. Smart streets, along with smart garbage system and smart parking system. This concept is efficiently implemented using various sensors and microcontroller. The state of art of smart city model [7],[10],[14],[15] have been described by various researchers along with its challenges in terms of deployment, security and interoperability issues.

2. LITERATURE SURVEY

1] Internet of things (IOT): A vision, architectural elements, and future directions. Authors – J.Gubbi and Buyya, Published in - 01 july 2012 Ubiquitous sensing enabled by Wireless Sensor Network (WSN) technologies cuts across many areas of modern day living. This offers the ability to measure, infer and understand environmental indicators, from delicate ecologies and natural resources to urban environments. The proliferation of these devices in a communicating–actuating network creates the Internet of Things (IoT), wherein sensors and actuators blend seamlessly with the environment around us, and the information is shared across platforms in order to develop a common operating picture (COP). Fueled by the recent adaptation of a variety of enabling wireless technologies such as RFID tags and embedded sensor and actuator nodes, the IoT has stepped out of its infancy and is the next revolutionary technology in transforming the Internet into a fully integrated Future Internet. As we move from www (static pages web) to web2 (social networking web) to web3 (ubiquitous computing web), the need for data-on-demand using sophisticated intuitive queries increases significantly. This paper presents a Cloud centric vision for worldwide implementation of Internet of Things. The key enabling technologies and application domains that are likely to drive IoT research in the near future are discussed. A Cloud implementation
using Aneka, which is based on interaction of private and public Clouds is presented. We conclude our IoT vision by expanding on the need for convergence of WSN, the Internet and distributed computing directed at technological research community.

2] Smart cities concepts and challenges bases for the assessment of smart city project Authors – A.Monzon Published in – 20 may 2015 internet of Things (IOT) has been widely researched over the past decade. Recently, many research results of IOT related to emergency system, smart building and medical system, etc. The key for IOT applications are the ability to interact with physical world through computation, communication, and machine control. However, each sensor device in IoT cannot conveniently communicate with other terminal devices through internet protocol. So, it is necessary to establish protocol translation stack or equipment between two WSN groups. That is very inefficient and high overhead cost of network construction. The development of micro-IP (uIP) solves this problem. The uIP reduce cost of protocol translation and it also realizes the machine to machine (M2M) concept in wireless sensor network.

3] Internet of things for smart cities Authors - A. Zanella, N.Bui, A. Castellani, L. Vangelista, and M. Zorzi Published in – 14 Feb 2014ASCIMER (Assessing Smart Cities in the Mediterranean Region) is a project developed by the Universidad Politecnica of Madrid (UPM) for the EIBURS call on ―Smart City Development: Applying European and International Experience to the Mediterranean Region‖. Nowadays, many initiatives aimed at analysing the conception process, deployment methods or outcomes of the -referred as- Smart City projects are being developed in multiple fields. Since its conception, the Smart City notion has evolved from the execution of specific projects to the implementation of global strategies to tackle wider city challenges. ASCIMER´s project takes as a departure point that any kind of Smart City assessment should give response to the real challenges that cities of the 21st century are facing. It provides a comprehensive overview of the available possibilities and relates them to the specific city challenges. A selection of Smart City initiatives will be presented in order to establish relations between the identified city challenges and real Smart Projects designed to solve them. As a result of the project, a Projects Guide has been developed as a tool for the implementation of Smart City projects that efficiently respond to complex and diverse urban challenges without compromising their sustainable development and while improving the quality of life of their cities.

3. PROBLEM STATEMENT AND OBJECTIVE

3.1 PROBLEM STATEMENT

AS we have seen number of times the dustbins are getting overflown and concern person don't get the information within a time and due to which unsanitary condition formed in the surrounding ,at the same time bad smell spread out due to waste, bad look of the city which paves the way for air pollution and to some harmful diseases around the locality which is easily spreadable.

3.2 OBJECTIVE

The goal is to facilitate wider uptake of IOT-based systems with an emphasis on sustainable smart city applications, but also in relation to a wider context.
1.Monitoring the waste management.
2.Avoiding human intervention.
3.Reducing human time and effort

4. EXISTING AND PROPOSED SYSTEM

4.1 EXISTING SYSTEM

In the current scenario we have seen number of times when it comes to street light, a concerned person should turn ON and OFF the street light during day and night time. And the concerned person may forget to do his work and that leads to loss of electricity. When the water is stored in the tanks no one can identify the level of water and also, no one can know when the water tank will fill and only when the tank is full and overflow the person will get to know about this and until then it leads to wastage of water.

4.2 PROPOSED SYSTEM

The Arduino is the interface used to connect multiple components such as LD where it is the light detector used in the street light interface. The dustbin is connected with the 2 sensors IR1 and IR2 which specifies whether the dustbin is half filled or full. 2 channel relay board is used to employ the switches to turn ON or OFF. The interface message will be directly uploaded to the PC which is connected to the internet, and through cloud computing the respective message will be sent to the of the particular user.

5. BLOCK DIAGRAM

A complete structure of the smart city involves the smart street light management, smart garbage system, smart parking system and weather monitoring system. The smart street light management section involves the ultrasonic sensor interfaced with Arduino mega and which in turn returns the values to the LED's that act as the street lamp.

Following diagram suggests the overall working of the project in a block diagram and how different sensor communicates with the Arduino. The web interface is attached by using the ESP8266 and is then connected to open source website of ThingSpeak. Overall the project involves two microcontrollers. One is Arduino Mega and another one is the Arduino Uno. These two controllers communicate with each other through handshaking protocol. The sensors like DHT11, ESP8266, MQ-135 are connected to Arduino Uno and the ultrasonic sensor, GSM module, Bluetooth sensors are connected with the Arduino Mega.

Smart Street Light Management System

The smart parking management system involves the android application which involves the camera which detects the black squares from the model and then will count the number of it. This value will be taken using the image processing which involves plotting the contours and then one area is marked around it. If the slot is covered by a

vehicle then the contour number will get reduced and then it will be informed to Arduino and through it to the customer

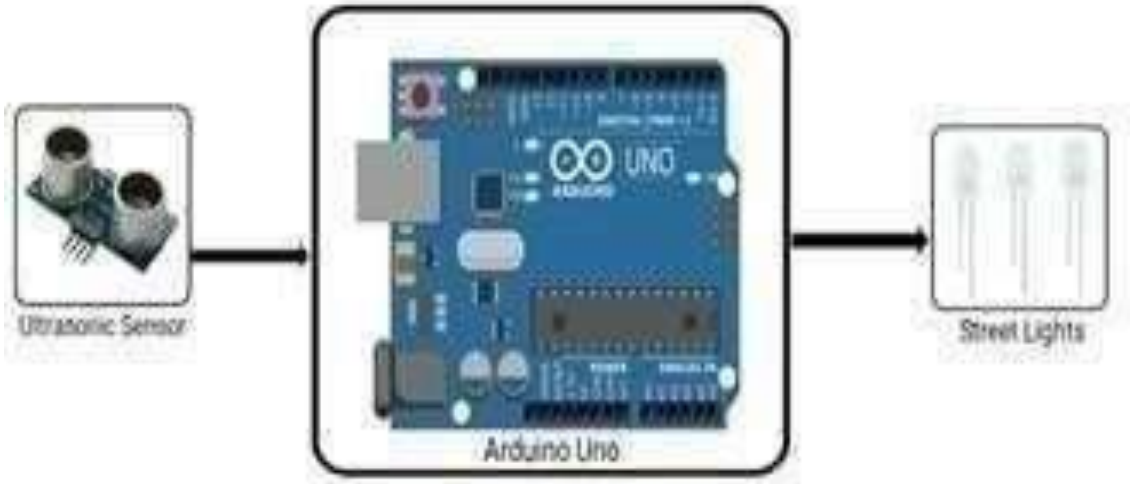

Fig 1.12 Smart Street Management System Interface

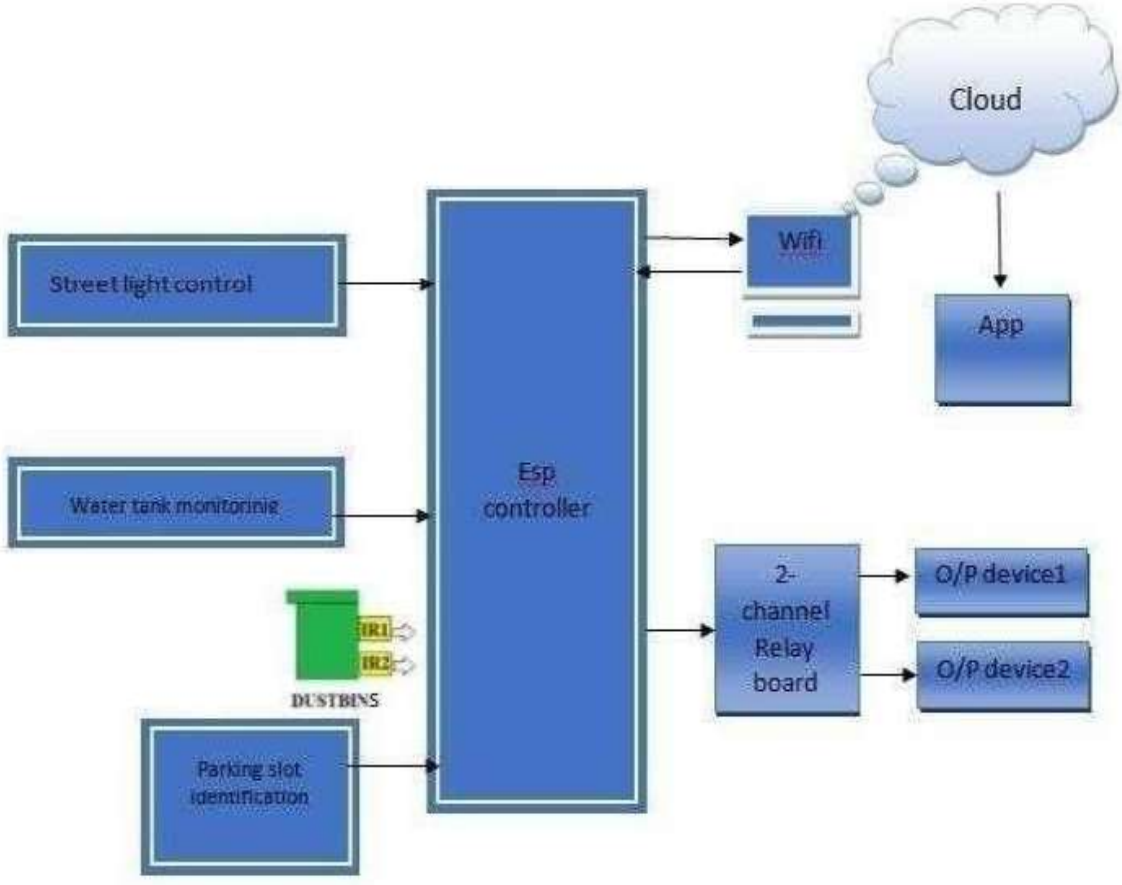

Fig: Smart City Block Diagram

6. HARDWARE REQUIREMENTS

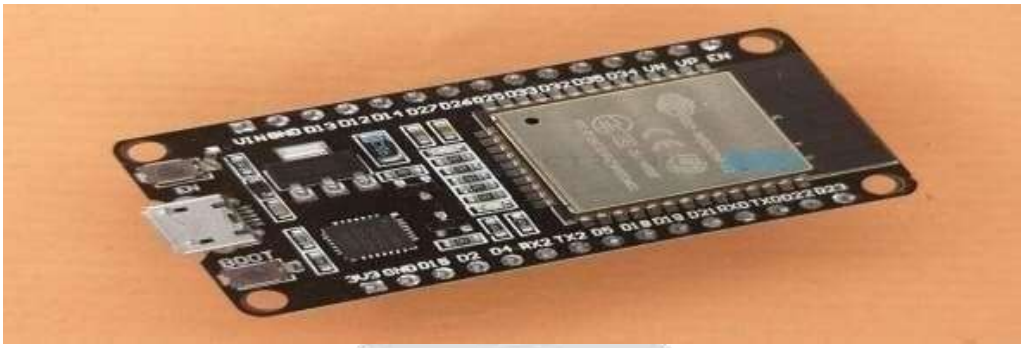

Fig: ESP32 SoC Microcontroller

ESP32 is a low-cost System on Chip (SoC) Microcontroller from Espress if Systems, the developers of the famous ESP8266 SoC. It is a successor to ESP8266 SoC and comes in both single-core and dual-core variations of the Tensilica's 32-bit Xtensa LX6 Microprocessor with integrated Wi-Fi and Bluetooth. The good thing about ESP32, like ESP8266 is its integrated RF components like Power Amplifier, Low-Noise Receive Amplifier, Antenna Switch, Filters and RF Balun. This makes designing hardware around ESP32 very easy as you require very few external components.

LDR

Fig: LDR with LDR Symbol

LDR or Light Dependent Resistor is one type of variable resistor. It is also known as a photoresistor. The Light Dependent Resistor (LDR) works on the principle of "Photo Conductivity". The LDR resistance is change according to the light intensity falls on the LDR. When light intensity increase on the LDR surface, then the LDR resistance will decrease and the element conductivity will increases. When light intensity decrease on the LDR surface, then the LDR resistance will increase and the element conductivity will decrease

IR Sensor

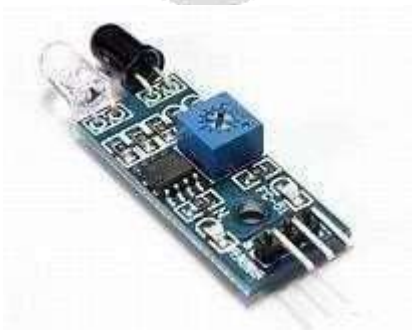

Fig: IR Sensor

An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 µm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests.

Float Switch

Fig: Float Switch

A float switch is a device that is used to detect the level of a liquid in a tank. Based on the water level, it will open or close an electrical circuit generally used to pump water in or out of the tank a facility allowing computers, smartphones, or other devices to connect to the internet or communicate with one another wirelessly within a particular area

Traffic Signal

Fig: Traffic Signal

Traffic signal - a visual signal to control the flow of traffic at intersections. traffic light, stoplight. light - a visual warning signal; "they saw the light of the beacon"; "there was a light at every corner" go-ahead, green light - a signal to proceed. red light - the signal to stop.

LEDS

Fig: LEDs

LEDs, in full light-emitting diode, in electronics, a semiconductor device that emits infrared or visible light when charged with an electric current. ... These compounds are members of the so- called III-V group of semiconductors—that is, compounds made of elements listed in columns III and V of the periodic table

2-Channel relay board

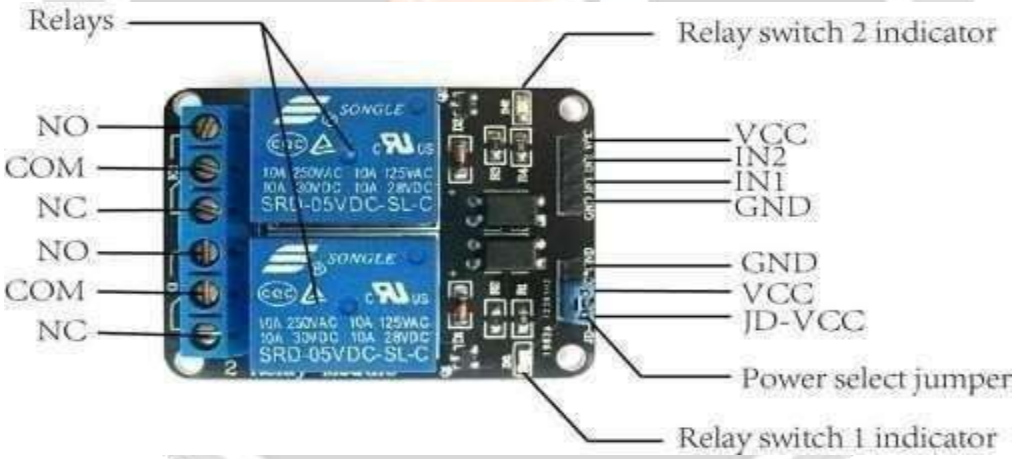

Fig: 2-Channel relay board

2-Channel 5V Relay Module is a relay interface board, it can be controlled directly by a wide range of microcontrollers such as Arduino, AVR, PIC, ARM and so on. ... Triggering the relay operates the normally open or normally closed contacts. It is frequently used in an automatic control circuit.

7. RESULTS

Smart Garbage Management System

The smart garbage management system has an ultrasonic sensor attach to the lid of the dustbin (big container). This will return the amount of the dustbin is filled currently by predicting the distance as calculated in the smart street light management. This value will be sent to the concerned authority using the GSM module (sim900).

Distance = speed * time Here, speed = 340m/s

Time = calculated by echo of ultrasonic in microseconds

Thus we will get the time from the sensor and then the speed will get multiplied with it to give the distance. To convert this into cm, convert speed into cm/s by applying a factor of 0.01.

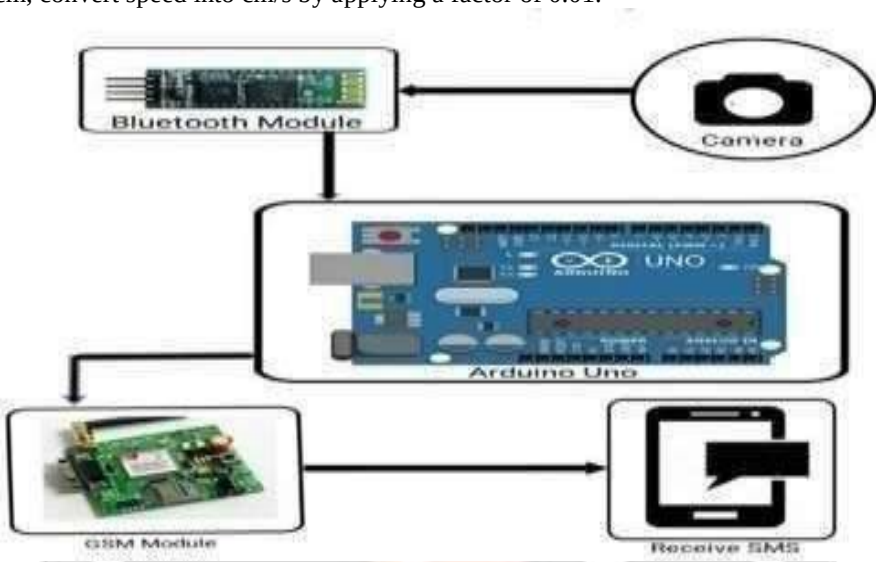

Fig 1.13 Interface for Smart Parking

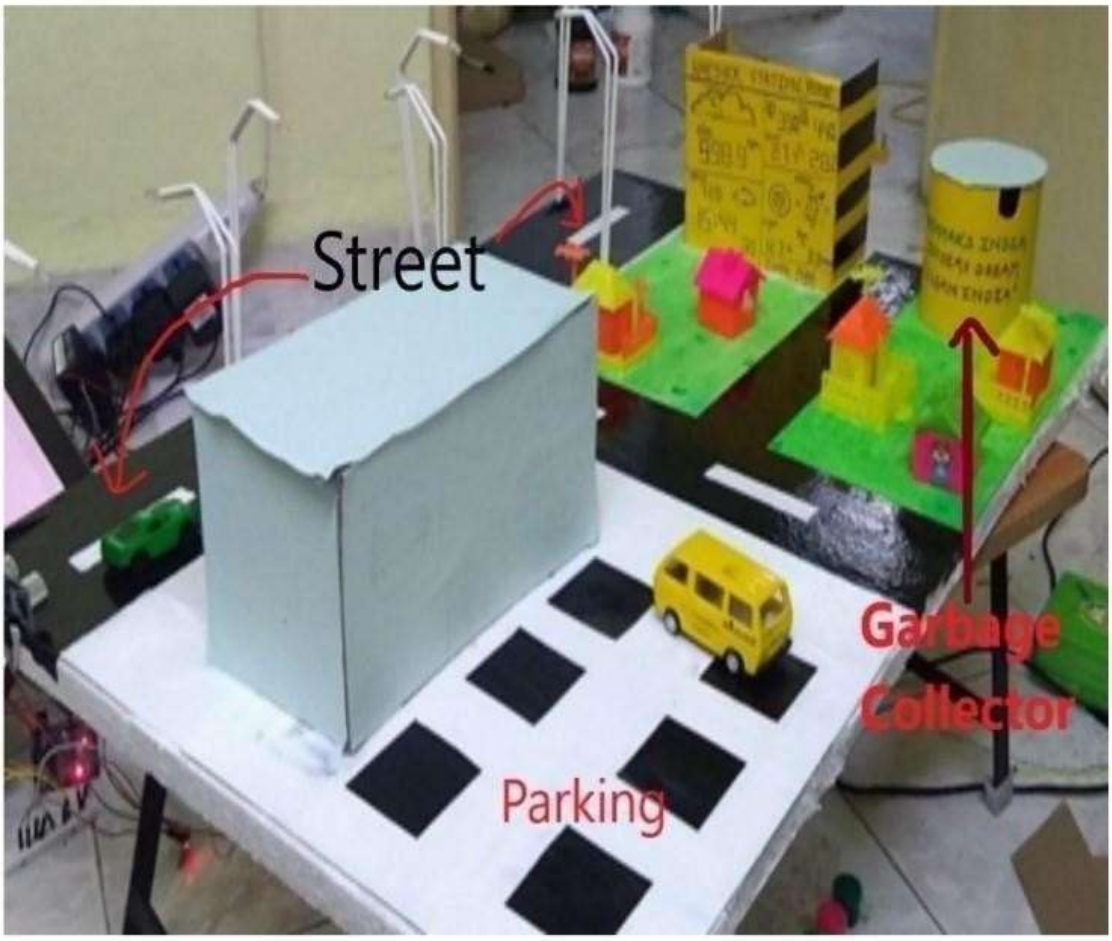

Fig 1.15 Prototype of Smart City

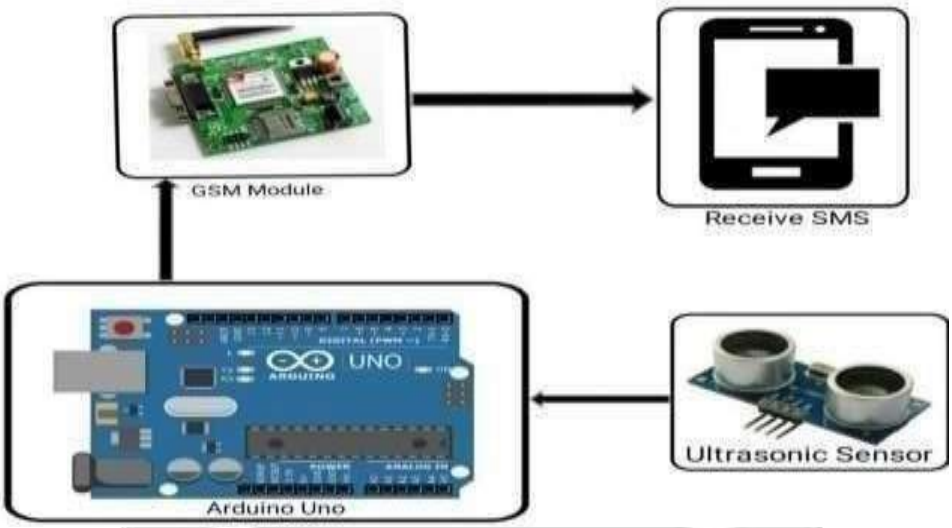

Fig 1.14 Interface for smart Garbage Management System

8. CONCLUSIONS

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 has been proposed.

After conducting all the successful trials the conclusion was derived as the city would work efficiently if all these sensors are effectively used for industry level. The sensors gave a proper reading in almost 95% of the time. The working of smart parking system turns out to be very effective in the day time as compared to the night time. The temperature readings were absolutely proper but the air quality reading was slightly misbehaving in case of SNO2 gas. The structure or the pattern which was plotted on the ThingSpeak website to help in understanding and predicting the future temperature and humidity conditions. Street Light would work even if there is interference in the sunlight unlike the IR sensors. The garbage system properly works through out the day and thus can be concluded as an efficient way for transmitting information about its state through the GSM module. Future scope for the project involves the major integration of all the sensors on one controller itself. The implementation of the image processing part can be more effective if there is a camera with better specifications. The Android app can have inbuilt facilities for connecting multiple users through Wi-Fi. Ultrasonic sensors of higher specifications will definitely give the precise readings. If all this is implemented on Raspberry instead of Arduino, the execution time may reduce and it can be beneficial. There could be various types of attack in an IoT based system. Few of them are man in the middle attack, DDOS, Device hijacking, data and identify theft and these can be avoided using algorithms like RSA. Thus, it is also planned to include such algorithms in near future.

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