International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 03 | Mar 2019 www.irjet.net p-ISSN: 2395-0072

IOT BASED GARBAGE MANAGEMENT SYSTEM USING ARM CORTEX-A53 PROCESSOR

R Ragavi[1], K Ram sundar[2], R Sabarigirivasan[3], C Thivagar[4], A Anuradha[5]

[1,2,3,4]*Students, Department of Electrical and Electronics Engineering, Valliammai Engineering College, Kattankulathur, Tamil Nadu, India.*
[5]*Assistant Professor, Department of Electrical and Electronics Engineering, Valliammai Engineering College, Kattankulathur, Tamil Nadu, India.*

Abstract - *Today, waste management from its collection to its disposal is one of the important challenge all over the world. Dust bins placed across cities at open places are flooding because of Increase in waste each day and making unhygienic conditions. To maintain a strategic distance from such circumstance we have proposed wireless garbage management system which allows us to monitor the status of dustbins remotely over web servers and keeping garbage bins clean without flooding of garbage. It consists of ultra sonic sensor, IR sensor, GPS, gas sensor to detect the level of garbage in bin using ultrasonic sensor and the count of garbage using IR sensor, gas level in the bin can be detected using MQ2 gas sensor. Location of the flooded bin can be found using GPS. These data are processed by raspberry pi and are send to the server via the internet connected system. The data can be analyzed by login to the server.*

Key Words: ***Raspberry pi, Internet of things, Ultrasonic sensor, IR sensor, Gas sensor***

1. INTRODUCTION

Due to increased population the garbage bins placed in the streets are flooding and due to the late disposal of those waste many unhygienic conditions may occur to the people in surroundings. The health problems may include dengue ,malaria etc which may be caused due to the mosquitoes. Other major health problems may also occur due to this. So cleaning of garbage bins in a timely basis very important for hygienic condition of the people. The proposed system consists of raspberry pi processors and sensors which accurately detect the level of garbage and the gas level in the garbage bins which is connected to the server via Internet of things. Waste management is very important for the cities for proper disposal of waste for which accurate detection of waste level in the bins is important. The existing System consists of humans directly checking the bins at a regular interval manually . But due to the laziness of the working people in the municipality or the time management problems can lead to delay of disposal of waste in the garbage bins which may spill in the streets and create unwanted smell and gases which may cause several problems to the people living in those areas. The miniature of the proposed system can be used in the houses for the small dustbins which we use in houses ,Colleges etc. This can help to keep the houses , colleges, schools etc to be clean. For a good city or a good environment cleanliness is an important factor for which this proposed system will be very useful.

2. METHODOLOGY

This system uses raspberry pi to operate the sensors such as the ultrasonic sensor to measure the distance of the waste inside the bin, IR sensor to calculate the IR count, mq2 gas sensor used to measure the level of gases in the bin. GPS sensor can be used to track the bins which are over dumped and releasing harmful gases. The data from the sensor can be collected using the raspberry pi and processed for analog to digital conversion. These data are send to server which is interfaced to the Rpi via Linux OS each sever has a dynamic or static IP address. These data can be analyzeded by login to the server. A notification will be sent to the mail or phone . Python programming can be used to program the sensors to the raspberry pi. Webpage is created using HTML.

3. BLOCK DIAGRAM OF PROPOSED SYSTEM

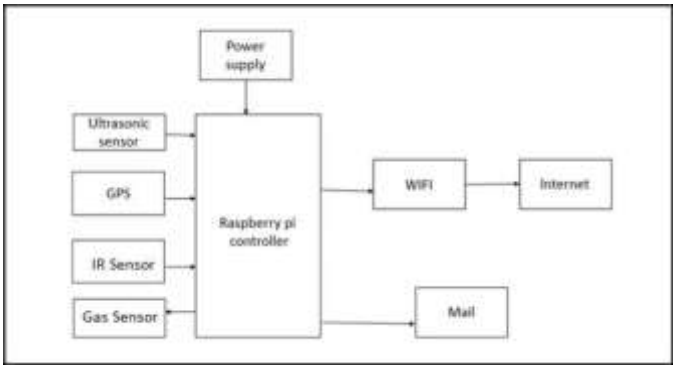

Fig – 1: Basic Block diagram

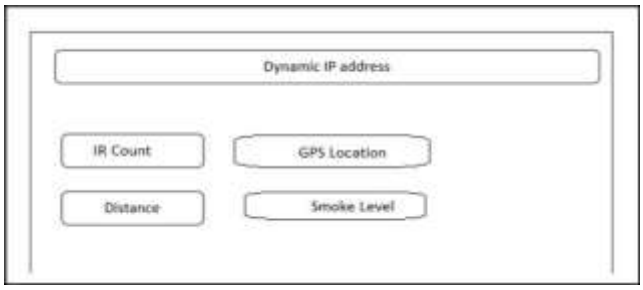

Fig - 2

4. RASBERRY PI

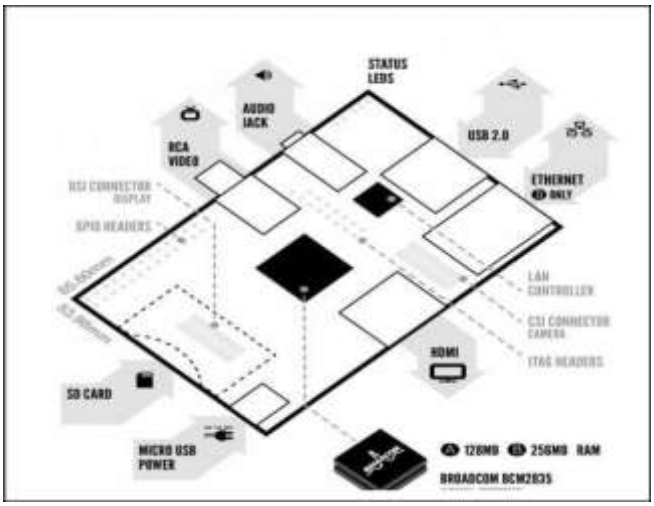

Fig – 3

Fig - 4

4.1 Power Supply:

The unit is powered by a 5v power supply which may from a standard USB mobile charger or from a normal socket. The power supply can also be reduced using a circuit which consists of a step down transformer, Bridge rectifier, Capacitors and a DC voltage regulator. It may be connected to the monitor via the HDMI cables and this acts as a processor for the computer. There is no separate CPU needed as this Raspberry pi acts as a CPU for the system.

4.2 Cables:

There are some cables required to connect the raspberry pi system to the monitor. HDMI-A cable, DVI adapter or Composite video cable and SCART adapter.

4.3 Internet Connectivity:

The internet connectivity may be through the mobile hotspot as the raspberry pi consists of the inbuilt wifi module or through the Ethernet or LAN cable. The Raspberry pi model consists of inbuilt Ethernet port. It can be connected to the router. Otherwise it can be connected to other computerdirectly.

4.4 USB hub:

To connect more devices to the Raspberry pi, separate USB hub is needed. It allows multiple devices to be connected to the Raspberry pi. A USB 2.0 is recommended for faster connection

4.5 CONNECTIONS:

- Plug in the preloaded SD card into the Raspberry pi. The SD card is used for the OS booting storage.
- The USB keyboard and mouse is connected to the Raspberry pi through the USB hub
- Through video cable RPi is connected to the monitor.
- These sensors and other extras are connected to the RPi. This is done through the USB hub.
- Power supply is connected to the mains socket.
- The RPi displays a screen in the monitor which is the home page for the raspberry pi. The datas and other programming can be done in this page.

The RPi takes a long time to boot when turned on first and power supply is given.

5. ULTRASONIC SENSOR

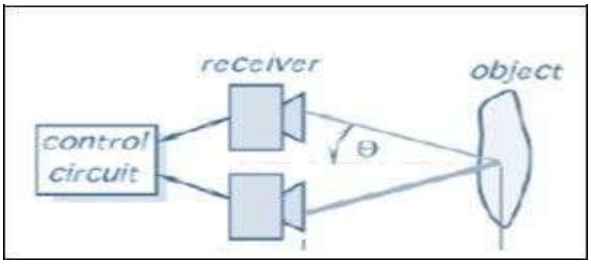

Fig -5

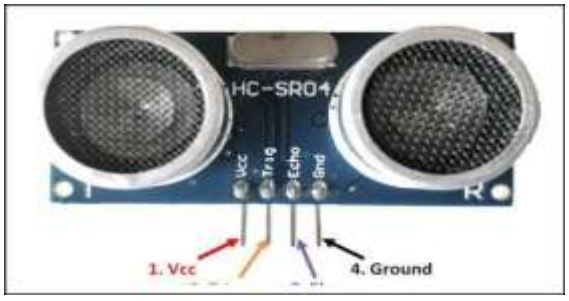

Fig-6

5.1 ULTRASONIC SENSOR HC - SR04

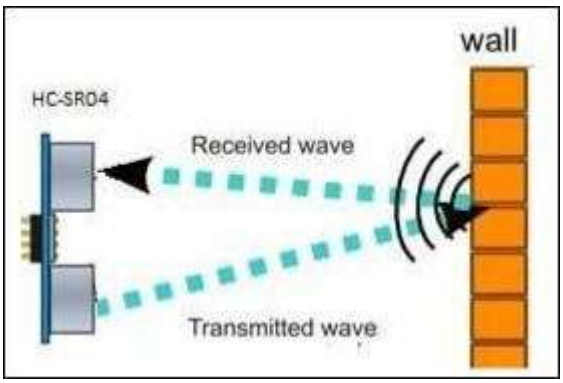

Fig -7

5.2 WORKING PRINCIPLE

Ultrasonic sensor module HCSR04 provides measurement upto 400 cm. It could be accurate upto 3mm. The module consists of a transmitter and a receiver. The IO trigger provides the trigger for the transmitter which sends the echo wave to the target . After hitting the target the wave is reflected back and send to the receiver. The receiver receives the wave and the distance of the target object can calculated easily by the simple formula(distance=speed*time). The ultrasonic sensor can be used to find the level of garbage in the bins. The sensor can be fixed to the lid of the bin. It avoids flooding of wastes in the bin.

6. INFRARED SENSOR

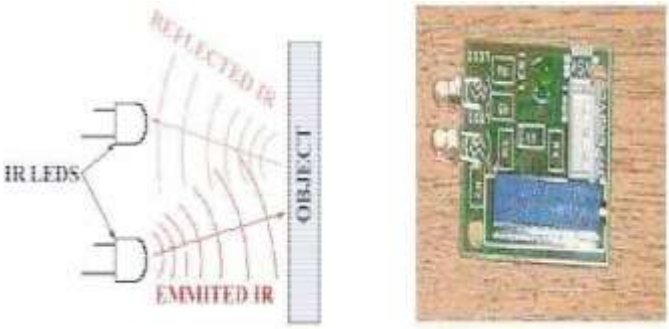

Fig – 8

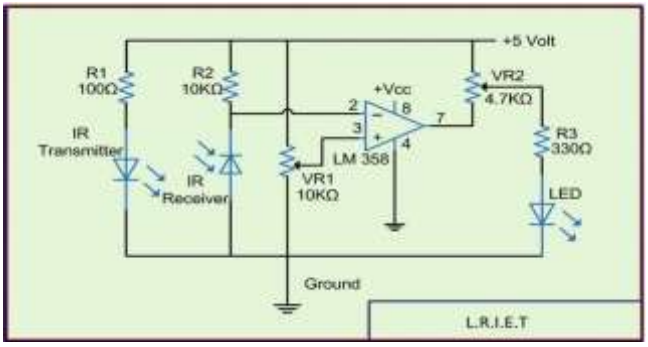

Fig – 9

6.1 WORKING

When the IR sensor does not receive a signal the LED does not glow. The voltage at the inverting output goes high than the non inverting input of the comparator. When IR sensor receives the signal the vice versa of the operation occurs and the inverting input goes low than the non inverting input of the comparator. The output of the comparator goes high and the LED starts glowing. This occurs every time an object crosses the receiver module. Resistors are use to allow minimum current to pass through the LED devices. The IR sensor can be used to find the IR count and it can be connected to the raspberry pi module. This can be placed in the garbage bins to find the number of items dropped into the bin.

Fig – 10

7. MQ2 GAS SENSOR

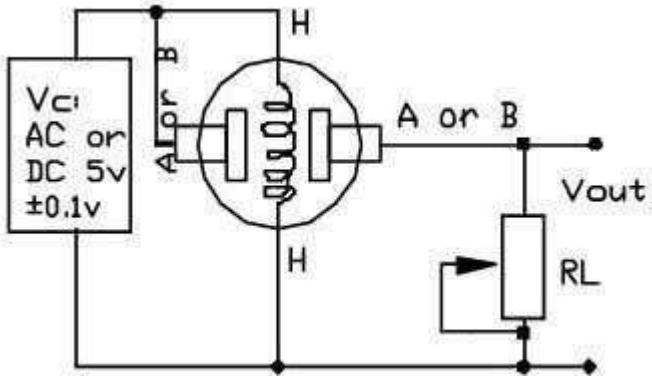

Fig – 11

Fig – 12

8. CHEMICAL SENSORS

MQ2 gas sensor can be used to find the level of gas in the sensor . The sensor consists of 4 pins Dout, Aout, GND, Vcc. The main gas formation in the garbage bins may be methane (CH4). The other gases also can be formed in the bins as anyone can put any type of materials in the bins. This sensor can sense variety of gases like propane, methane, alcohol etc. The output result of sensor is in the parts per million(ppm). This is a main system in the garbage management system as main disadvantage of the garbage bin in the city is formation of gas in bins which may cause health problems. It senses and send the gas level to the server.

9. POWER SUPPLY CIRCUIT DIAGRAM

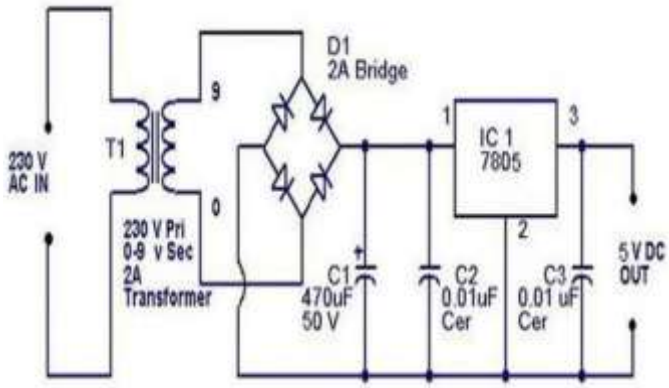

Fig – 13

10. GPS SENSOR

Fig – 14

Gps sensor is a device used to find the latitudinal and longitudinal location of a person or a material .In this project the location of the garbage bin which is detected as over dumped are excess of gas formation in the bin. Exact location of the bin can be detected using this sensor which is connected to the raspberry pi.

11. INTERNET OF THINGS

IoT has a layered architecture designed to answer the demands of various industries, enterprises and society. shows a generic layered architecture for IoT that consist of fivee layers, which are discussed, in the following

- Edge Technology layer
- Access Gateway layer
- Middleware layer
- Application layer

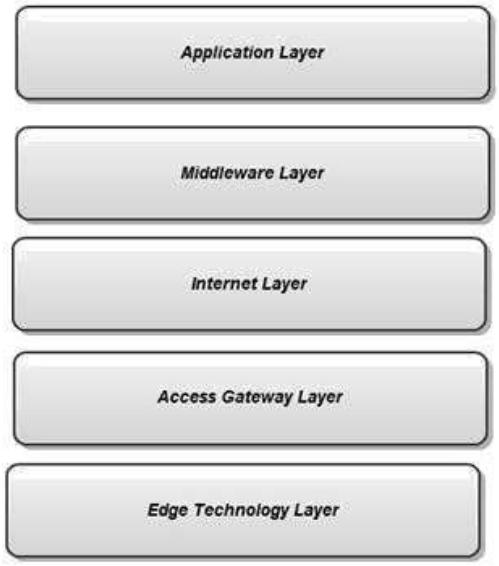

Fig - 15

internet of things one or more garbage bins can be connected to the server. Garbage bins are connected and programmed with the ultrasonic sensor, IR sensor, Gas sensor, GPS sensor. The data collected from each sensor is processed by the raspberry pi and it is connected to the server by using Linux OS. The server has a static IP address or dynamic IP address. The data processed will be send to the server .The data can be analyzed for the flooding of garbage bins and excessive formation of unwanted gas, which may lead to unhygienic conditions. The latitude and longitudinal position of the particular bin will be send to the server. Two or more bins can be interconnected using internet of things in which each bin is fitted with sensor and controller module. It will be of great use for the future smart clean cities. Each bin is a smart bin with electronic modules which will allow the bins to be over dumped or to produce unwanted gas to an extent which may cause health problems.

12. RESULT ANALYSIS

The output of the proposed system is displayed in the webpage created by using HTML. The output from the sensors like the ultrasonic sensor, Gas sensor, IR sensor, GPS

is processed by the raspberry pi and send to the server. The level of gas, distance of garbage in the bin from the lid of the bin ,exact latitude and longuitude location of the bin which is dumped more than the limit can be found out in the web page. Notification mail will be send to user which is included in programming part.

13. CONCLUSION

The proposed system consists of smart garbage bins which will be of greater use in future cities. The developed system provides future scope for the smart cities to keep the cities clean. The system can be used for residential purpose also. The data send related to the garbage management to the server can be analyzed and cleaning process can be done.

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