IoT Based Garbage Collection System

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Abstract: **Waste management has always been a major issue for all the developing countries around the world. Often, in our society we come across overloaded and unattended garbage bins. It not only makes that place look ugly but also leads to unhygienic conditions resulting into widespread of diseases and foul smell in the vicinity. Also, the health and safety of the labor involved in the garbage collection process is ignored. It is our insufficient and irresponsible waste management system to be blamed for. In order to avoid such situations and to provide a smarter and more reliable alternative, we have come up with an interesting project called 'IoT Based Garbage Collection System'. Our project not only deals with the present waste management problems efficiently but also offers zero human assistance feature. It is a fully automatic system consisting of some Smart Garbage Bins and a Garbage Collecting Robot. In the Smart Garbage Bin, we have used an ultrasonic sensor which constantly monitors the level of garbage in the bin and display its status on the LCD module. Whenever the garbage level crosses the 75% mark of the bin, it will notify the Robot. The communication between the Smart Bin and the Robot will take place using a Wi-Fi Module. The Robot will immediately respond to the call alert and start the garbage collection process. The Robot will reach the specified location of that bin and unload it using its arms.**

Keywords: **Arduino UNO, AT mega 328p, Internet of Things (IOT), Robot, Smart Waste Management, Ultrasonic Sensors etc.**

1. Introduction

The Internet of Things (IoT) is a concept of connecting surrounding objects over a network (Wired or Wireless) without any human intervention. These objects communicate over the network and exchange information to provide the required services. Improper disposal of waste and inefficient waste management system are some major issues faced by every developing nation and so taking into consideration the properties and advantages of IoT, the 'IoT Based Garbage Collection System' could prove really useful. It deals with the problems of waste management in a smarter and organized manner. It consists of two parts, one is the garbage monitoring system and the second is the garbage collecting robot.

2. Purpose

As the world population is increasing rapidly, the amount of waste produced daily is also increasing and due to lack of proper systems for disposal and collections, the garbage often ends up in the roads and surroundings. The waste management policy followed presently proves to be ineffective. The garbage collecting trucks moves from area to area with no proper status of the garbage in these areas. Also, the health and safety of the labor involved in these processes are often ignored. Presently available systems are all single feature technologies. For example, the Smart Bins just gives an indication of the level of garbage and no solid action is generally taken. The problem with Garbage Picking Robot is that it collects every other object that comes in its way, irrespective of the fact that is it really a waste or not. The prime purpose of implementing this system based on IoT in a developing country is the social and economic infrastructure of the country itself. The initial stage of this system comprises of proper disposal and collection, which is the biggest challenge. In addition, to motivate and influence people to follow proper waste disposal methods is also important.

3. System description

'IoT Based Garbage Collection System' is a combination of Garbage Monitoring and Collecting mechanism. This results in complete elimination of human assistance in the process. This Garbage Monitoring mechanism consists of a Smart Bin interfaced with an LCD screen and a Wi-Fi Module. This system monitors the level of garbage in different bins using ultrasonic sensors connected with ATmega 328p Microcontroller in the Arduino UNO kit. The Microcontroller is also connected to an LCD screen which constantly displays the level of garbage in the bin. The Wi-Fi Module transmits this information to the Garbage Collecting Robot. The garbage collection process takes place using a Robot. After the garbage level crosses the 75% mark, it instantly activates the Robot. It is a combination of Line Follower Robot and Obstacle Avoiding Robot. It also has two mechanical arms which are electrically controlled using gas/hydraulic struts for unloading the Garbage Bin. This Robot uses IR Transmitters and Receivers for its line following property mechanism and Ultra Sonic Sensor for avoiding obstacles. DC Gear Motors are connected to all four wheels of the Robot which are controlled using Motor Driver IC L293D. After unloading the Bin, it is put back to its original position.

4. Important hardware components

A. Ultrasonic sensor

As the name indicates, ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic

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International Journal of Research in Engineering, Science and Management
Volume-1, Issue-11, November-2018
www.ijresm.com | ISSN (Online): 2581-5792

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wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception.

Fig. 1. Ultrasonic sensor

B. Wi-Fi module

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Fig. 2. Wi-Fi module

C. Arduino UNO

The Arduino Uno board is a microcontroller based on the ATmega328. It has 14 digital input/output pins in which 6 can be used as PWM outputs, a 16 MHz ceramic resonator, an ICSP header, a USB connection, 6 analog inputs, a power jack and a reset button.
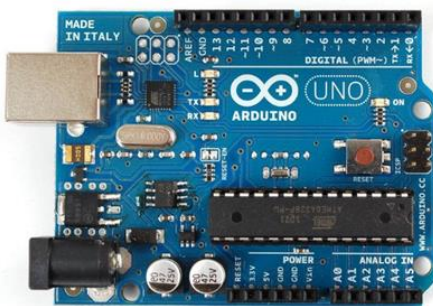

Fig. 3. Arduino UNO

D. Dc gear motor

A DC motor is not the same as a "gear motor" - a "gear motor" may be an AC or DC motor coupled with a gearbox or transmission. A gear motor adds mechanical gears to alter the speed/torque of the motor for an application. Usually such an addition is to reduce speed and increase torque.

Fig. 4. DC Gear motor

E. Motor driver circuit

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.
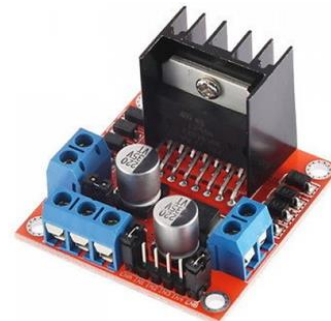

Fig. 5. Motor driver circuit

F. Lead acid battery

These batteries use sponge lead and lead peroxide for the conversion of the chemical energy into electrical power, such type of battery is called a lead acid battery. The lead acid battery is most commonly used in the power stations and substations because it has higher cell voltage and lower cost.

Fig. 6. Lead acid battery

G. IR sensor

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.

Fig. 7. IR Sensor

International Journal of Research in Engineering, Science and Management
Volume-1, Issue-11, November-2018
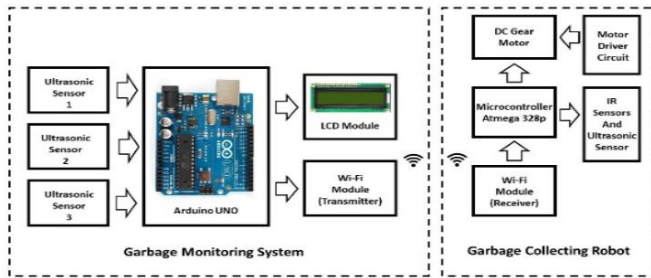**www.ijresm.com | ISSN (Online): 2581-5792**

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5. Block diagram

Fig. 8. . Block Diagram of IoT Based Garbage Collection System

6. Drawbacks

The only drawback of this system is poor performance in the absence of light as the IR Sensors follow black/white lines in the line follower mechanism. So, it is difficult for the robot to follow these lines in the dark (at night).

7. Conclusion

Implementation of 'IoT Based Garbage Collection System' will give waste management system an unbelievable push and also reduce health hazards caused to the people employed in this sector. Using this system, the level of garbage can be monitored by checking them on the LCD Screens attached to the smart bins. Also, there is no need of any manual assistance for unloading these bins as a Robot has been deployed for this very purpose. It can initially be tested at corporate offices, schools, colleges etc., before manufacturing them on a larger scale.

Acknowledgement

References

[1] Sandeep M. Chaware," Smart Garbage Monitoring System using IoT," International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering, Volume 5, Issue 1, Jan 2017.
[2] Apoorva S," Autonomous Garbage Collector Robot", International Journal of Internet of Things, 2017.