

# Design of Smart Bin Using Arduino

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**Abstract:** Nowadays, the whole world is becoming smarter and smarter. Each and every where we can encounter with many smart things like smart phones, smart watches etc. With development of this technology there evolved many smart cities. This is the latest trend in the new era where every city is trying to convert into smart city. This requires many things to be changed and modified in such a way that it makes our life fast, comfortable and secure. The first thing that comes into the mind about smart cities is cleanliness. To maintain the locality or city clean it is necessary to have an idea of smart dustbin which overcomes the conventional dustbins where they get over-filled and remained over the same place for many days, which spreads many diseases and illness everywhere. The main objective of this paper is to escalate and improvise the methods of garbage system. This intimates the supervising department about the details of garbage in that dustbin and they are going to move accordingly.

## 1. Introduction

This is the era of SMART. The whole world is filled with smart things like smart phones, smart watches etc. People are also interested only in smart things, so that they can reduce their work and improve their livelihood. From there the concept of SMART has been started and being implemented in each and every corner. To maintain our localities neat and clean the idea of **smart dustbin** has been aroused [1].

Earlier the dustbins are like a simple bin that are placed at a corner and everyone just comes there and throws their waste into it as shown in figure1. This might leads to unhealthier surroundings. Nowadays, the idea of using some mechanical system comes into the picture that helps to minimise the drawbacks of the conventional bins as shown in figure 2. The idea of using the mechanical system automatically opens the lid, sense the waste, sends information, displays some required information of the bin and many more. The smart bin automatically opens, whenever any person comes nearby the lid of the bin. When the bin senses the presence of human closer to the bin, then immediately the lid opens automatically. It cannot detect everything that comes nearby; it gives value high only if a living thing comes into its range [2].

The idea here is to place the sensor at some height which detects the human beings only as shown in figure 3. This bin not only detects the level of the bin but also measure the weight of the garbage[3-7].



**Figure-1:** Simple Dust-Bin



**Figure-2:** Dust-Bin with mechanical support

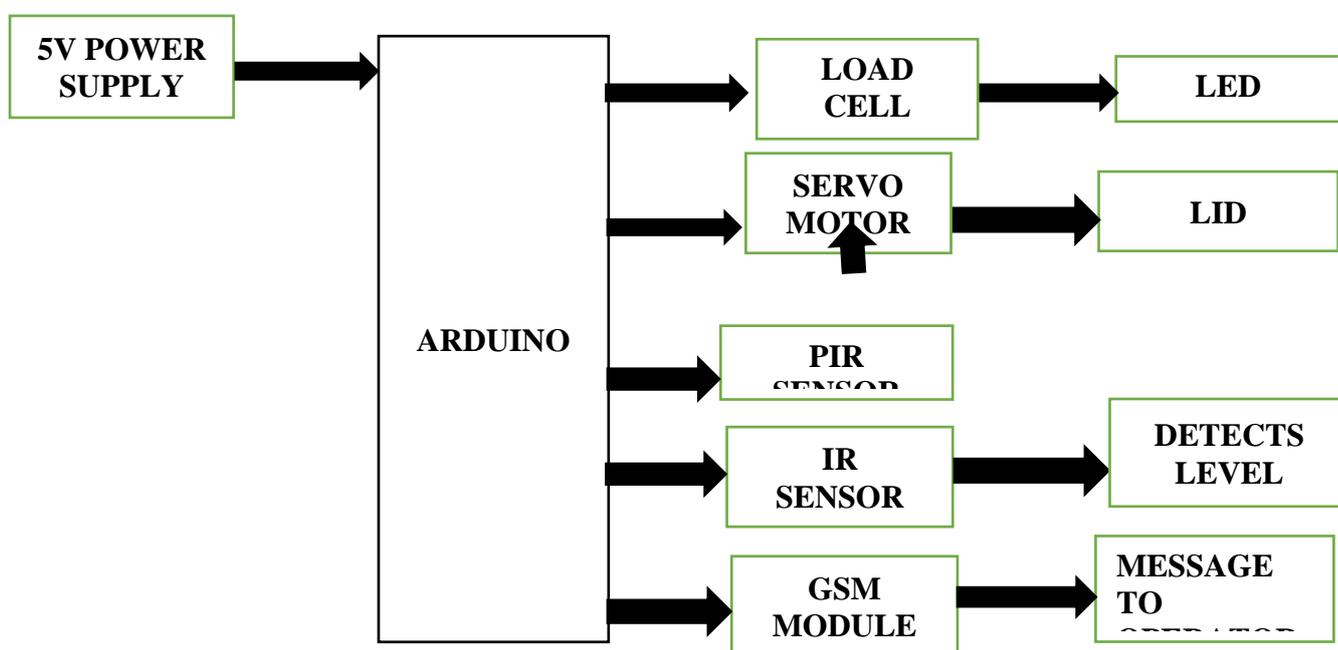


**Figure-3:** Smart dustbin

When the level and weight inside the bin exceeds the threshold value, then it intimates the managing department of the garbage that the bin is filled. The information of the filled bin not only sent to the supervising department, but it is also displayed on the screen of the LCD which is placed at front part of the bin so that the people will also get to know about the status of the bin whether it is filled or not.

## **2. Materials and Methods**

The main components required for the design of smart bin are Arduino NANO, Liquid Crystal Display (LCD), IR Sensors, PIR Sensor, Servo Motor, SIM 900a GSM module, Load Cell, HX-711, and Bread Board. The block diagram of the hardware for the design of smart bin as shown in figure 4. The Arduino Nano is a microcontroller board that based on the ATmega328 as shown in figure 5. The LCD (Liquid Crystal Display) has the rod shaped tiny molecules which has the flat piece of glass and opaque substrate sandwiched in between [3-4]. IR Sensors works as a proximity sensor for detecting the light in the Infra-Red (IR) spectrum. PIR sensors don't detect or measure "heat"; instead they detect the infrared radiation emitted or reflected from an object [8]. Servomotor works on the principle of servomechanism.



**Figure-4:** Block Diagram of hardware circuit of Smart Bin

### 3. Circuit Description

The circuit diagram is divided into following parts:

1. Power Supply to Arduino Boards
2. Interfacing Arduino with Servo Motor
3. Interfacing Arduino with LCD
4. Interfacing Arduino with IR sensor
5. Interfacing Arduino with PIR sensor
6. Interfacing Arduino with SIM 900A GSM Module
7. Interfacing of HX-711 with Load Cell

8. Interfacing Arduino with HX-711

3.1 Power Supply to Arduino Boards

Firstly, for giving power supply to Arduino boards we are using power bank which gives 5v output then it is given to Arduino boards through Arduino cables.

3.2 Interfacing Arduino with Servo Motor

When interfacing Arduino with servo motor we have to connect the data pin of servo motor to the digital pin of Arduino and remaining two pins of servo motor is given to 5v and ground as shown in Figure 5.

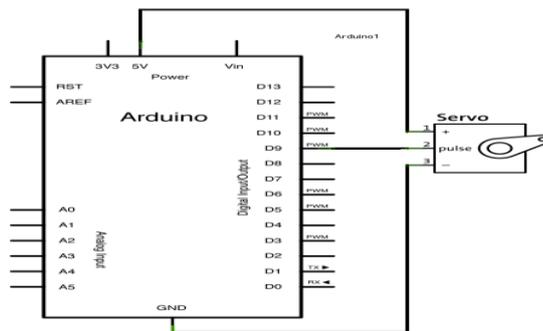


Figure-5: Circuit Diagram of interfacing Arduino with servo motor

3.3 Interfacing Arduino with LCD

While interfacing with Arduino with LCD, we have to give sufficient power supply (5v and GND) to LCD as it requires in LCD total eight data pins will be there out of eight four data pins should be connected to the four digital pins of Arduino and register select pin and enable pin of LCD should connect to the digital pins of Arduino as shown in Figure 6.

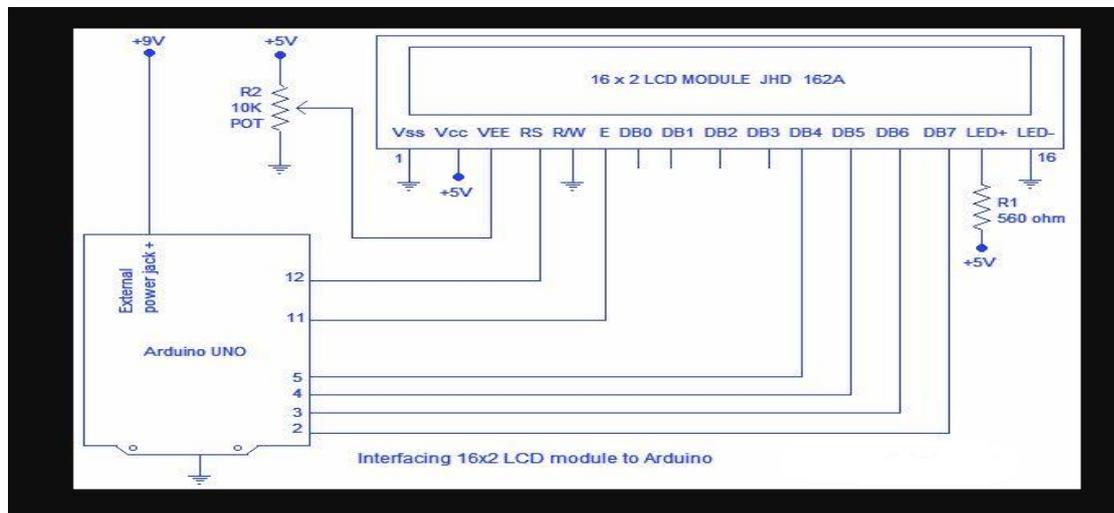


Figure-6: Circuit Diagram interfacing Arduino with LCD

### 3.4 Interfacing Arduino with IR sensor

While interfacing IR sensor, IR sensors has a three pins first pin should connected to the 5V power supply, second pin should connected to the ground and third pin is data pin which should connect to the digital pin of Arduino as shown in Figure 7.

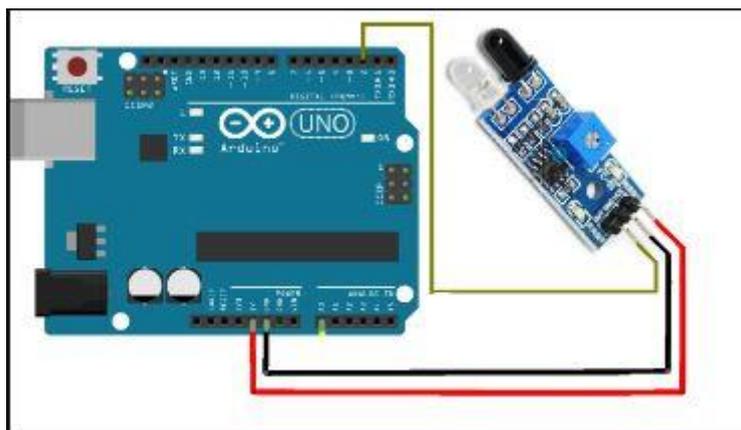


Figure-7: Circuit Diagram of interfacing Arduino with IR sensor

### 3.5 Interfacing Arduino with PIR Sensor

When interfacing Arduino with PIR sensor, we generally connect data pin of PIR sensor connect with any digital pin of Arduino. Similarly, 5V and ground are taken from Arduino board to sensor as shown in Figure 8.

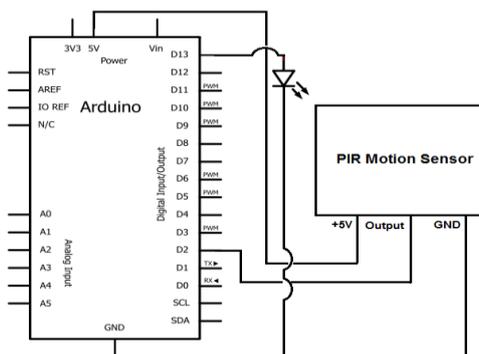
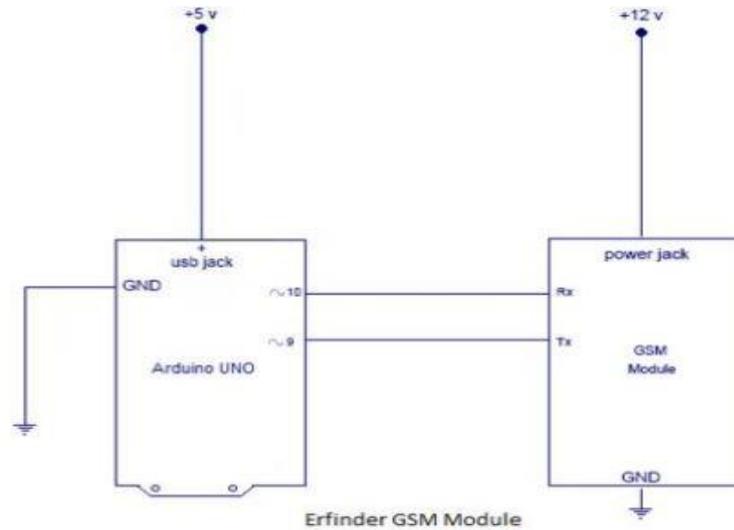


Figure-8: Circuit Diagram interfacing Arduino with PIR sensor

### 3.6 Interfacing Arduino with SIM 900A GSM Module

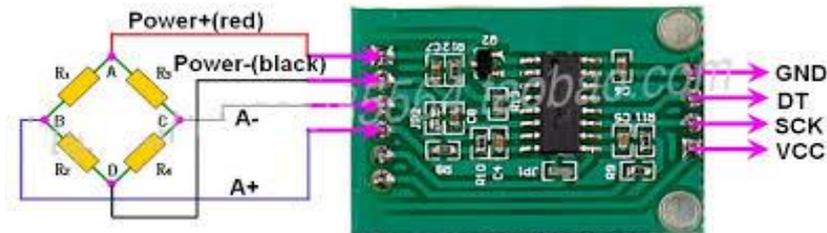
The gsm module have four pins first pin is 5V power supply, second pin is ground, third pin is Rx pin and fourth pin is Tx pin. The Rx pin of GSM module is connected to the Tx pin of arduino and Tx pin of GSM module is connected to the Rx pin of arduino. The communication between the arduino and GSM is serial communication as shown in Figure 9.



**Figure-9:** Circuit Diagram of GSM module

**3.7 Interfacing HX-711 with Load Cell**

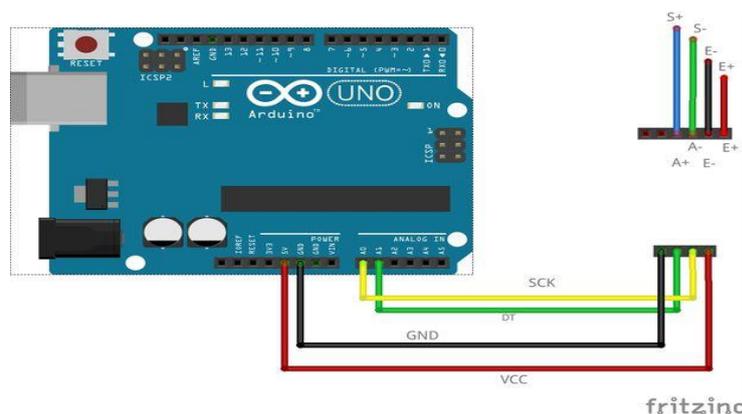
HX-711 has 10 pins out of which 4 are used to interface load cell to HX-711. Load cell has also 4-pins these are connected to E+, E-, A-, A+ of amplifying IC. This will amplify the output voltage signals of the load cell as shown in Figure 10.



**Figure-10:** Interfacing of Load Cell and HX-711

**3.8 Interfacing Arduino with HX-711**

The pins of HX-711 is connected to Arduino to record the values of output signals from the load cell. The pins of HX-711 (GND, VCC, DT, SCK) are connected to analog pins of the Arduino (A0 A1). The VCC is connected to 5v and GND of HX-711 to GND of Arduino as shown in Figure 11.



**Figure-11:** Interfacing diagram of HX-711 with Arduino

#### 4. Results and Discussion

Smart Dustbin, by the sounding of name itself we can say that the bin should be a smart thing to use, so simply it should just respond to our action and it should make our work more easy than if we do it by our self.

Simply a Dustbin deals with garbage, litter and all the unnecessary things which we feel waste so we throw them into the bin. So, the first reflex of the bin should start with our action to throw something into the bin.

##### 4.1 Working of Automatic lid opening

In this project, we placed a Passive Infra-Red sensor which senses the radiation produced by a body of a living thing. So whenever a person/animal approaches near the bin to throw something into it, the sensor will sense the radiation delivered by a person and will make the system know that a person is approaching the bin as shown in figure 12.



**Figure 12:** Automatic Lid Opening

The PIR Sensor is also placed diagonally facing upward so that if any animal passes nearby bin it won't be able to detect it and the lid won't open. Hence an unnecessary opening of the bin is avoided.

And for the purpose of opening the lid of the bin we placed a Servo motor, so by the movement of the servo motor the lid gets open when we approach the bin [9-11]. Both PIR sensor and servo motor are interfaced together with the Arduino Nano to work together.

## **5. Conclusions**

On account of conclusion we can deduce that the work done in this paper "SMART DUSTBIN" is a primary step on being developing in domestic and industrial areas and can contribute a lot for the cleanliness and tidiness with less human intervention, so under this can we can say a line "CLEAN SMART BE SMART GROW SMART". Also, this work can be modified further depending on the requirements needed. Although there are some chances for some disadvantages, in case of maintenance department handling with the bin, as for every coin there will be a head and a tail similarly for everything there will be some pros and cons, so we can neglect that.

## **References**

- [1] S. V. Kumar, T. S. Kumaran, A. K. Kumar, and M. Mathapati, "Smart garbage monitoring and clearance system using internet of things", IEEE International Conference on Smart Technologies and Management for Computing Communication Controls Energy and Materials (ICSTM), pp. 184-189, 2017.
- [2] S. Thakker, and R. Narayanamoorthi, "Smart and wireless waste management," International Conference on Innovations in Information Embedded and Communication Systems (ICIIECS), pp. 1-4, 2015.
- [3] M. Arebey, M. A. Hannan, H. Basri, and H. Abdullah, "Solid waste monitoring and management using RFID GIS and GSM," IEEE Student Conference on Research and Development (SCOREd) UPM Serdang, pp. 37-40, 2009.
- [4] M. Hannan, M. Arebey, R. A. Begum, and H. Basri, "Radio Frequency Identification (RFID) and communication technologies for solid waste bin and truck monitoring system," Waste Management, vol. 31, pp. 2406-2413, 2011.
- [5] P. R. Naregalkar, K. K. Thanvi, and R. Srivastava, "IOT Based Smart Garbage Monitoring System," International Journal of Advanced Research in Electrical Electronics and Instrumentation Engineering, vol. 6, no. 5, May 2017.

- [6] S. D. Satyamanikanta, and M. Narayanan, "Smart garbage monitoring system using sensors with rfid over internet of things," *Journal of Advanced Research in Dynamical and Control Systems*, vol. 9, Sp-6 2017.
- [7] K. T. Akash, S. Y. Dineshchoudhari, C. U. Sandeep, and P. M. Rashmi, "IOT based garbage monitoring system," *International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)*, vol. 6, no. 4, April 2017.
- [8] R. M. Saji, D. Gopakumar, H. Kumar, K. N. Mohammed Sayed, and S. Lakshmi, "A Survey on Smart Garbage Management in Cities using IoT," *International Journal of Engineering and Computer Science*, vol. 5, no. 11, pp. 18749-18754, Nov 2016.
- [9] V. Bhor, P. Morajkar, M. Gurav, and D. Pandya, "Smart Garbage Management System," *International Journal of Engineering Research and Technology (IJERT)*, vol. A, no. 03, March 2015.
- [10] S. Shukla, and N. Shukla, "Smart Waste Collection System based on IoT (Internet of Things): A Survey," *International Journal of Computer Applications*, vol. 162, no. 3, March 2017.
- [11] The EUs approach to waste management", available: <http://ec.europa.eu/environment/waste/index.htm>.