

# **EE322: Embedded Systems Design - Project**

## **SMART DUSTBIN DESIGN**

### **Project Proposal**

Date of Submission : 17 / 10 / 2022

Reg No E / 18 / 372 : VIDURANGA W.H.R.

Reg No E / 18 / 381 : WEERANAYAKE H.S.S.

Reg No E / 18 / 383 : WEERASINGHA W.K.H.M.

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# **SMART DUSTBIN**

## **Introduction**

As the embedded system project, decided to make a smart dustbin. While lowering management costs, resource requirements, and roadside emissions, smart dustbins contribute to creating a cleaner, safer, and more hygienic environment and improved operating efficiency. They are perfect for congested areas like campuses, amusement parks, airports, train stations, and shopping centers.

In this project, there proposed to design the bin with some intelligent options like automation lid open and close function, displaying the level of free space available in the bin, and using IoT to send notifications for managing purposes. When a person or object approaches within a certain distance, the dustbin's lid will automatically open. After waiting a predetermined amount of time, the lid will automatically close.

This smart dustbin is based on a microcontroller-based system and features ultrasonic sensors, stepper motors, a display, and a battery on the dustbin. Assembly programming language is to be used to program the microcontrollers to fulfill these tasks.

## **Problem Identification**

The project's main goal is to design a smart dustbin that will aid in keeping our environment clean and environmentally friendly. If the dustbin is not kept clean, it can create an unhealthy environment and pollute the air, affecting our health. Our country's population is rapidly growing, and there is also an increase in garbage, which has exacerbated environmental issues.

- I. Garbage causes environmental pollution – like air pollution, soil pollution water pollution
- II. Harm to animals and vegetation
- III. Greenhouse gas emissions
- IV. If using normal dustbins in case they are full no one is there to clean them, and the garbage is spilled out.
- V. Sometimes waste time, and cost and reduced the cleaning efficiency.

To avoid and reduce these problems, smart dustbins can do a major part. The smart dustbin is also intriguing, and people have fun with it, so it will help to maintain cleanliness.

## **Proposed Solution**

HCSR04 ultrasonic sensor interfacing with pic microcontroller will be a solution to environmental pollution and other problems that mentioned above. Ultra-sonic sensor is used to detect the amount of garbage in dustbin. Also, it can be used to identify the person who needs to put the garbage. It can be used for hospitals, schools, universities and all the other public places. This sensor has high sensitivity and very fast response. This sensor interfacing with ATMEGA328P Microcontroller can be built at low cost.



Figure 01: HCSR04 Ultrasonic Sensor

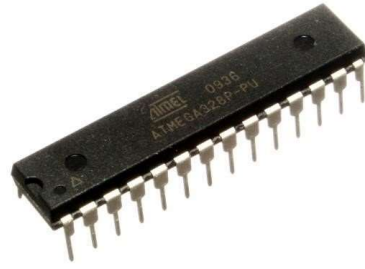


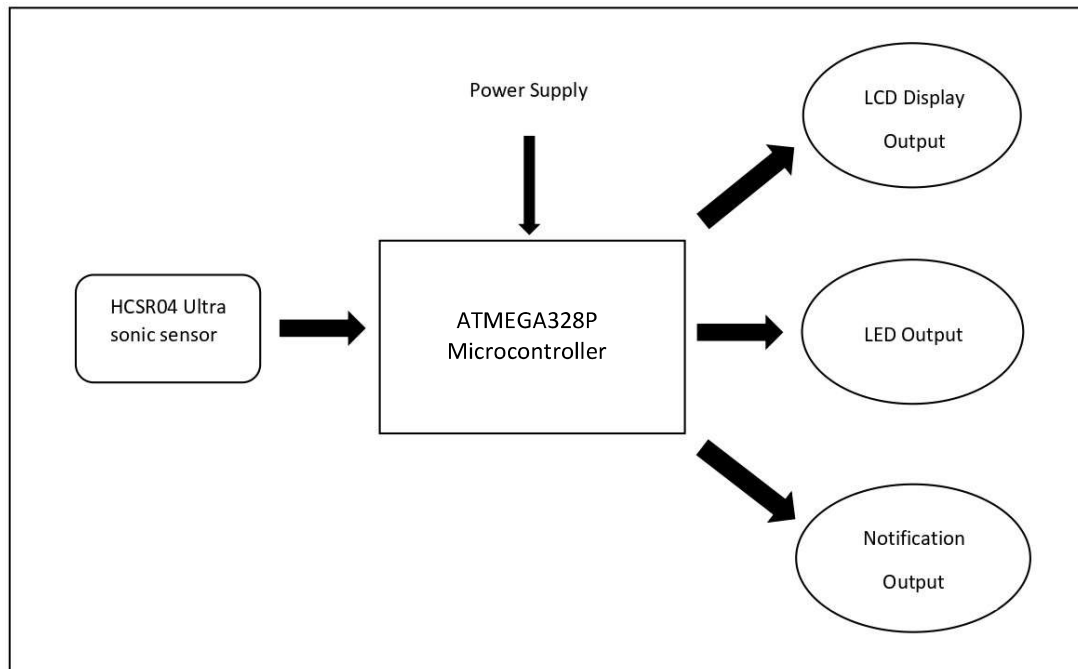
Figure 02: ATMEGA328P Microcontroller

## **Market Analysis**

The above embedded system we describe is, mainly about to detect the motion and detect the percentage of garbage level in dustbin to remove quickly. When considering the market analysis, it can only take considerable amount garbage. In public places that might be a problem because dustbins filled very quickly. To get better market value or make it more applicable for the market, embedded system must be enhanced to complicated level. System can be developed by adding sorting method and increasing the capacity.

To be useful, our system should upgrade with detectors that can be coupled with notifications. Notification systems which can provide a notice to staffed monitoring station either on or off site. In the other hand it can develop with some notifications which may go directly to the municipality.

## **Implementation (Methodology)**



The implementation of the circuit is done using the above block diagram. This can be used as a multi output system. Hence, the programmer has the freedom to add any kind of an output. Since we are planning to build the project in the purpose of detecting the movement towards the dustbin and amount of garbage as a percentage to LCD display. Also planning to build LED output after fill the full capacity of the dustbin and notification to remove the garbage.

HCSR04 sensor is chosen as the device to recognize the input. This sensor is mainly applicable for measuring the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electric signal. Ultrasonic waves travel faster than the speed of audible sound. Therefore, faster output can be get and sensor shows high sensitivity.

Analog output pin of the sensor is connected with the analog input pin of the microcontroller. For the project ATMEGA328P Microcontroller is used. This PIC is selected mainly because it contains sufficient number of input & output pins (8 pins). Analog channel of the PIC is used to measure the output voltage of sensor. There are three output ports with 8 pins in this PIC. Corresponding output pins needed for the notification, LCD and the LEDs will be decided in the schematic implementation step.

## **Cost Analysis**

TABLE 01: Approximated cost analysis

<b>Description</b>	<b>Unit Price / Rs</b>	<b>Quantity</b>	<b>Total /Rs</b>
Atmel ATMEGA328P Microcontroller	1800.00	1	1800.00
HCSR04 Ultra Sonic Sensor	450.00	2	900.00
Resistors	2.00	5	10.00
LEDs	2.50	4	10.00
Breadboard (For implementation purposes if needed)	250.00	1	250.00
Wires / cable set	680.00	1	680.00
16x2 LCD Display	840.00	1	840.00
Other expenses	1000.00		1000.00
Total			5490.00

## Timeline (Gantt chart)

TABLE 02: Approximated Gantt chart

Action	Time (Week)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Selecting a suitable project (problem and solution)														
Studying programming in Assembly language														
Choosing a suitable hardware component (microcontroller, sensor components)														
Creating the simulation														
Estimate the cost and buy all the hardware parts														
Hardware implementation on Bread board and PCB														