

## **Automatic Door for Cat with Air Freshener Sprayer**

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**Abstract:** The majority of air freshener used nowadays rely on time delay or the sublimation process. Cat owners frequently encounter issues with their cats' litter boxes. This also happens to people who are always busy and away from their homes. The project proposes an automatic and precise door opening system based on cat movement sensing near the door, which is provided by ultrasonic sensor. The system also includes an intelligent air freshener with an automatic door, which includes a user-operated remote controller that detects the signal via an infrared or ultrasonic sensor. This study aims to develop a motion detection sensor capable of opening and closing doors, monitoring objects, displaying results on LCD. A system that involves a litter box equipped with a software called the Blynk Application, which is used to notify the user when their cat is using the litter box. The purpose of this notification is to allow the user to know whether their cat is inside the litter box or not, even when the user is not physically present. To ensure safety, it will be equipped with ultrasonic sensors to sense any obstructions that are in its way. Lastly, the air fragrance with the use of sensor and Blynk Application is proposed for the system.

**Keywords:** Motion Detection, Ultrasonic Sensor, Air Fragrance, Blynk Application

### **1. Introduction**

In the most rooms, air fresheners are need. The majority of air freshener used nowadays rely on timer delay mechanism or the sublimation process. The room freshener gel and sachets are left out in the open to release a pleasing scent, and the timer-based systems regularly carry out the same function with the aid of a mechanism built into them. However, because they have to be manually controlled and release aroma into the space unnecessary, they can be wasteful. The idea behind smart air freshener is to utilise sensors to detect cats and then use a timer-based controller to release scent into air. To make it easier for cats to access the litter box, upgrade with automatic door at the same time, when the cat enters the litter box, sensors active the timer. The timer will begin to run after the sensor has been activated but before the air freshener is sprayed.

Demand for air fresheners in rooms is constant, as individuals attempt to maintain a pleasant and odor-free environment. Cat owners confront the difficulty of maintaining clean and hygienic litter boxes for their pets. Conventional air fresheners rely on timer delay mechanisms or sublimation processes, which frequently result in the wasteful and unimportant release of aroma. Our project proposes an innovative solution to this problem: an odor-removing cat litter box with an automatic door. Using motion-sensing technology and a programmable air freshener, this system seeks to provide cat owners with improved convenience and cleanliness.

Our project's primary objective is to create an automated door mechanism that detects cat movement and provides simple access to the litter box. This mechanism used infrared and ultrasonic sensors to detect the presence of cats near the door and open it accordingly. By eliminating the need for manual intervention, the system guarantees that cats can effortlessly enter and exit the litter box. In addition, the system includes a timing spray mechanism that allocates controlled quantities of air freshener at certain times. This helps neutralise the unpleasant odors related to litter boxes, developing a consistently pleasant environment for both cats and the owners.

Our system includes a user-friendly interface based on the Blynk application to provide simple control and monitoring for users. Using their smartphones or other connected devices, users can remotely control the automatic door and air freshener discharge systems through this interface. The Blynk application enables convenient customization of the air freshener spray's timing settings and provides real-time monitoring of the system's status. With the incorporation of motion sensors, a programmable air freshener, and a user-friendly interface, our system provides a comprehensive solution that improves the well-being of both cats and the owners by providing a clean and fresh living environment.

## 2. Material and Methods

This project's method and materials are based on a previously studied project that corresponds to the required components. This project's objective is to design and develop a system that can detect cat movement entering and exiting a litter box and enable remote monitoring via the Blynk application.

### 2.1 Material

ESP32 is the most important electronic component used in this project's development. The remaining items has been listed just below Table 1.

**Table 1: The list of components**

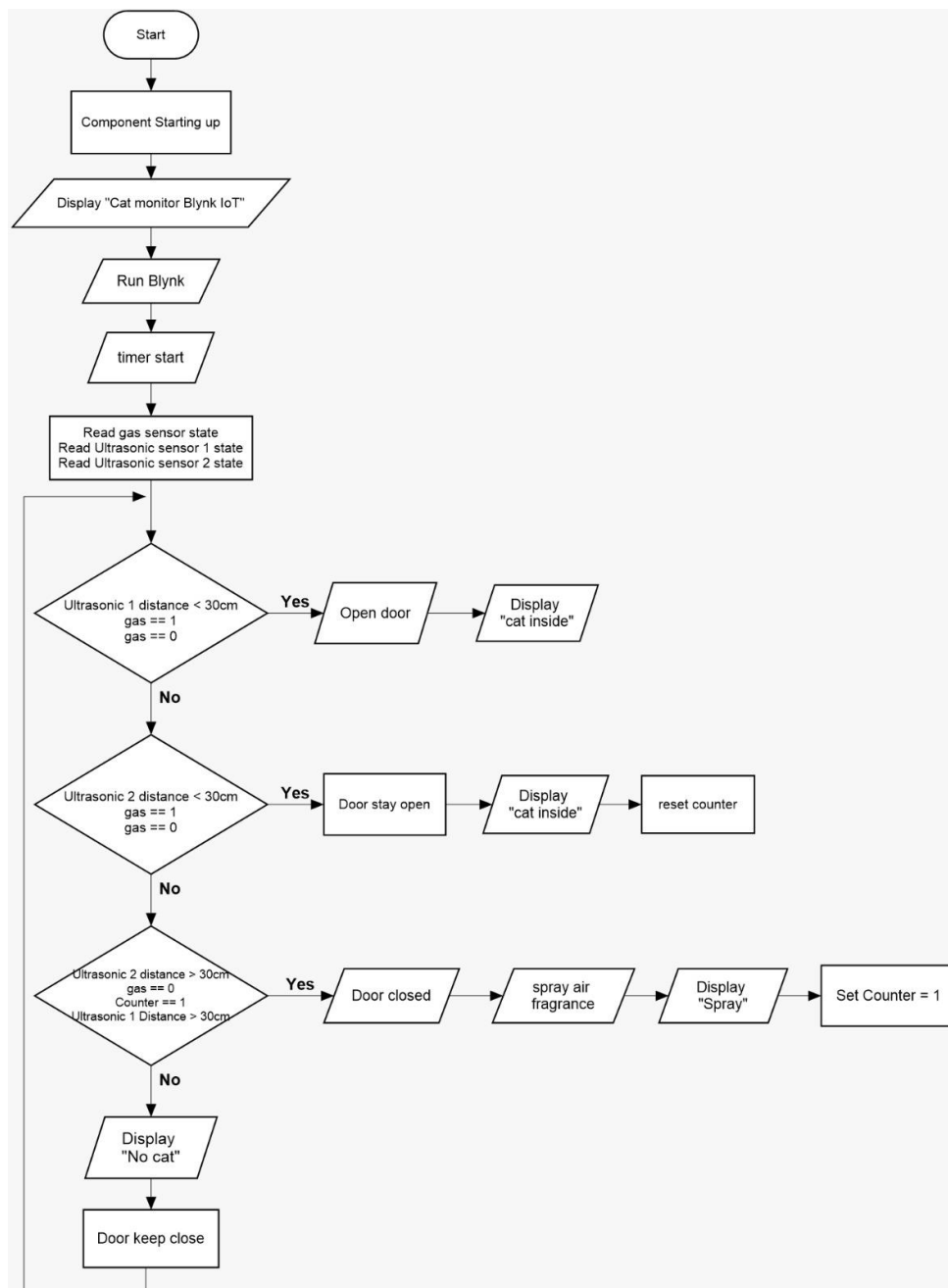
<b>List of Components</b>
- ESP32 wroom-32E
- MQ-5 Gas sensor
- HC-SR04 Ultrasonic sensor
- LCD 2x16
- Servo motor

## 2.2 Method

A project plan and schedule are essential for a successful outcome of the Odor-Removing Cat Litter Box with Automatic Door System implementation. This project plan contains a diagram showing the project's workflow.

### 2.2.1 Flowchart of the systems

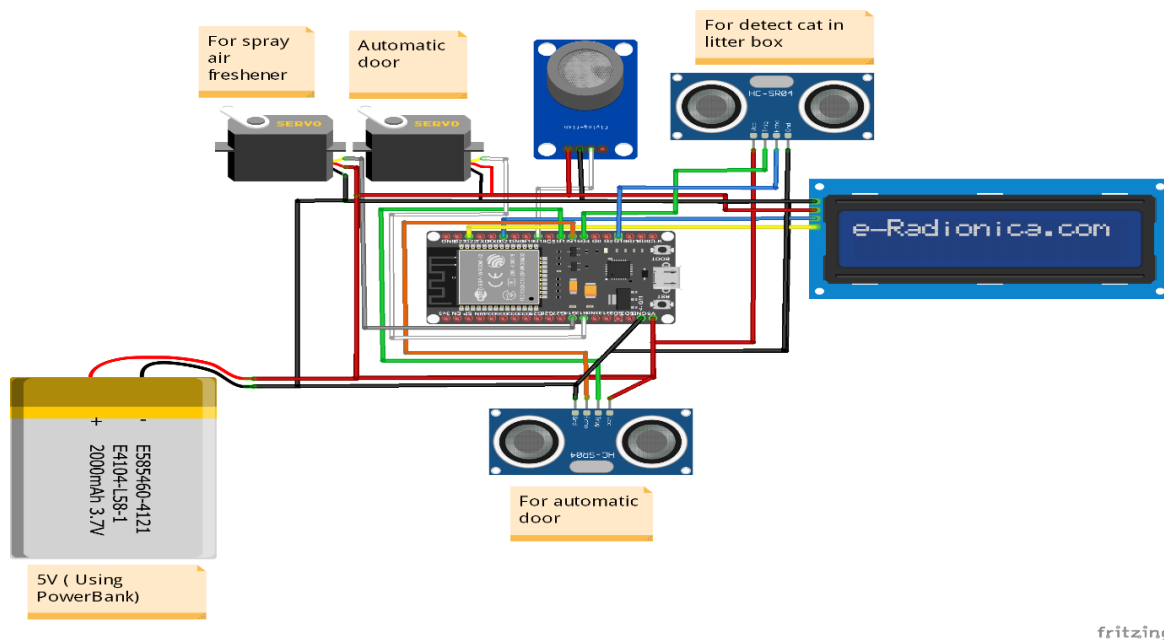
The programming begins with the flowchart, which is necessary for the step-by-step problem-solving procedure. Using this programming technique, it was able to display the process flow and instructions for the programmed code to solve the problem. The flowchart for the odor-removing cat litter box with automatic door is shown below:



**Figure 2: Odor- Removing Cat Litter Box with Automatic Door flowchart**

### 2.3 Odor-removing cat litter box with automatic door simulation process

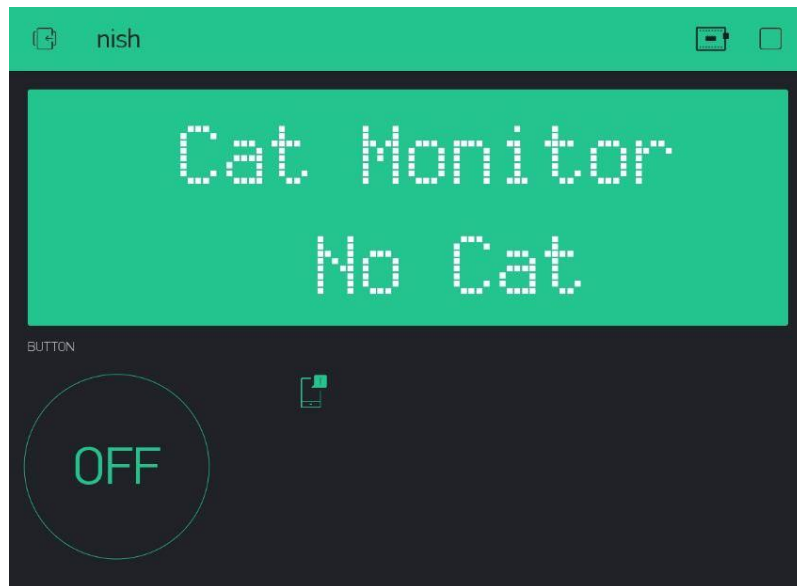
The Fritzing programme was used to implement the simulation. An open-source hardware project called Fritzing enables anyone to use electronics as a creative medium. In the spirit of Processing and Arduino, they provide a software tool, a community website, and services. Figure 4 shows the odor-removal cat litter box with automatic door simulation using Fritzing.



**Figure 4: Simulation of Odor- Removing Cat Litter Box with Automatic Door**

### 2.4 Blynk web app as a monitoring platform

Blynk is a well-known Internet of Things (IoT) platform that supports the development of mobile applications to control and monitor connected devices. It provides a drag-and-drop interface for the creation of smartphone applications and a cloud-based backend infrastructure for app-to-hardware communication. With Blynk, you can construct custom interfaces, known as "Blynk apps," that allow you to control a variety of IoT devices, including Arduino boards, Raspberry Pi, ESP8266, and other compatible hardware. The platform supports a number of communication protocols, such as Wi-Fi, Ethernet, Bluetooth, and cellular data.



**Figure 5: Blynk application software**

### **3. Results and Discussion**

The purpose of the experiment is to measure the efficiency of an odor-removing cat litter box with an automatic door system. According to the programming code, the data is based on the operation of the automatic door, air freshener, and monitoring system.

#### **4.1 Results**

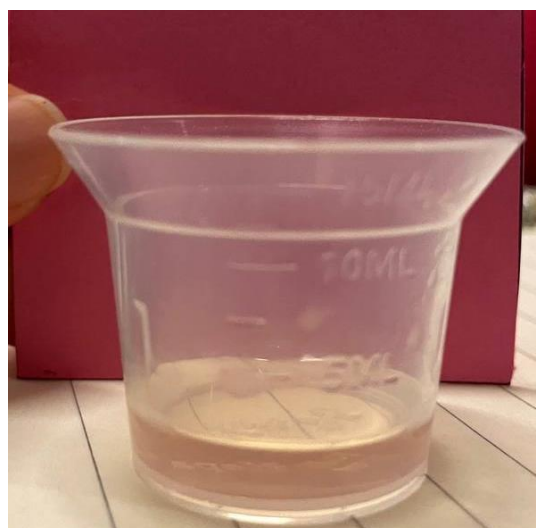


**Figure 6: Object in front ultrasonic**

**Table 1: Cat distance experimental result of ultrasonic sensor**

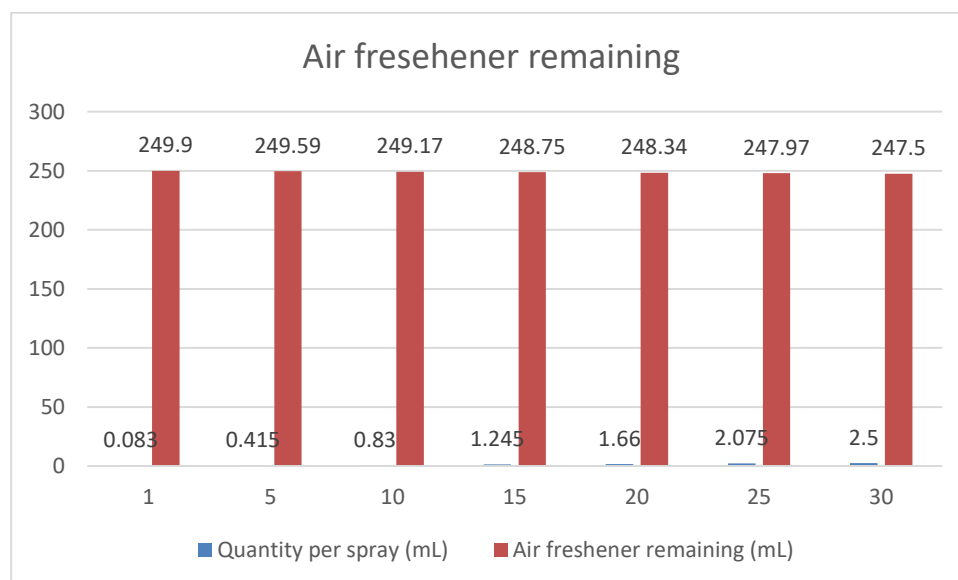
Distance (cm)	Sensor Information
10	Sensor Detection "Cat Inside"
15	Sensor Detection "Cat Inside"
20	Sensor Detection "Cat Inside"
25	Sensor Detection "Cat Inside"
30	Sensor Detection "Cat Inside"
35	Sensor Detection "No cat"
40	Sensor Detection "No cat"

In Figure 6, the figure shows the object in front ultrasonic that measure the distance. According to the Ultrasonic sensor's results from experiments, the sensor noticed the existence of a cat inside at distances of 10 cm, 15 cm, 20 cm, 25 cm, and 30 cm. However, at a distance of 35cm, the sensor detected "No cat," and this result remained unchanged at a distance of 40cm.

**Figure 7: Measure the quantity per spray**

**Table 2: Result of the test air freshener remaining**

Spray	Quantity per Spray (mL)	Air Freshener Remaining (mL)
1	0.083	249.9
5	0.41	249.59
10	0.83	249.17
15	1.25	248.75
20	1.66	248.34
25	2.08	247.97
30	2.5	247.5

**Figure 8: Graph of the test air freshener remaining**

In Figure 7, it shows measuring cup for measure the quantity per spray. The table presents the results of the spray experiment, including the amount of air freshener dispersed per spray in millilitres (mL) and the amount of air freshener that remains in millilitres. According to the data, 0.083 mL was used for the first release, leaving 249.9 mL remaining. Subsequent amounts of 5, 10, 15, 20, 25, and 30 produced quantities of 0.41 mL, 0.83 mL, 1.25 mL, 1.66 mL, 2.08 mL, and 2.5 mL, with an equal decrease in the remaining quantity. Figure 8 shows the graph of the testing air freshener remaining.

**Table 3: Monitoring system performance on second day testing**

Time (minutes)	Gas remaining in litter box
0	Yes
1	Yes
5	Yes
10	No
15	No

Figure 9 shows the recorded data, during the testing period, the gas remained present in the litter box at the initial time and after 1 minute and 5 minutes. However, after 10 minutes and 15 minutes, there was no gas detected in the litter box.

### Discussion

The efficiency of the systems was functional, but not as expected, considering the complicated layout of the experimental setup. The experiment was designed to test the ultrasonics' potential to detect distance, determine remaining air freshener and determine how long the gas was still in the air. Several issues prevented the outcome from being as predicted. Before the performance test, the air freshener must be configured because the air freshener nozzle disconnected unexpectedly and could not be used, and the ultrasonic must be configured in a strategic location for detection. The measuring value of air freshener during the performance test was therefore excluded from the data analysis and result. When testing the object in front of the ultrasonic, the performance and efficacy of ultrasonics were in excellent shape. The monitoring system is also functioning well, but not as expected due to coding and component issues. The problems came from the coding for "no cat" and "spray." Based on the observed data, the MQ-5 sensor is unsuitable for the measurement. Overall, all systems were operational and functioning in accordance with the project objectives.

### 4. Conclusion

In conclusion, the odor-removing litter box with an automatic door provides cat owners with a highly convenient and effective solution. The automatic door ensures that the litter box remains closed, minimising the spread of unpleasant aromas throughout the room. By incorporating odour-removing technology, the litter box effectively eliminates and neutralises odours, providing cats and their human owners with a fresh and clean environment. The automatic door function also adds an additional layer of privacy for cats, providing a comfortable, undisturbed place for them to use the litter box. With this creative design, cat owners can experience a simple and odor-free litter box, thereby enhancing the well-being and comfort of both cats and their human companions. Achieving this objective involves implementing sensors to detect cat movement in and out of the litter box, monitoring behavior, and activating additional actions. An automated system with a timing release mechanism distributes air freshener to eliminate odours. A user-friendly UI for the Blynk application enables remote monitoring and management of automatic door and air freshener discharge systems, providing convenience and usability.



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