Abstract

Pets have integrated themselves into our everyday lives in the modern world. Almost every family in the globe, at least one pet can be found. But because of our busy lifestyle that we follow till today, we frequently forget to feed our dogs and remember later in the day. Thus, the Automatic Cat Feeder is an innovative solution for feeding pets. It will use an Arduino Uno and a servo motor which will feed the supplied food to the pets. In a certain interval of time, the motor will rotate which will dispense the food loaded into the bowl. This device will be an elegant and efficient solution to a problem which recurs frequently.

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- ## Introduction

The IoT, or Internet of Things, is a network connecting various devices to the internet. It includes everyday items like phones, appliances, and even pets. Automatic Cat Feeder is an IoT device that feeds pets every four hours, addressing the issue of neglect due to busy lifestyles.

- ### Current Scenario

Technology has transformed the way we care for pets, making our lives easier and enhancing theirs. Previously, pets required constant care and regular feeding from humans, impacting both owners and pets' behavior due to the need for human interaction and regular meals. However, modern technology now allows for automated feeding systems, ensuring pets receive food and attention regularly, alleviating potential issues for both pets and their owners.

Some of the advantages of this system can be seen below:

- It is automatic so doesn’t need human presence.
- It saves time and is very efficient.
- It helps to nurture the cats and support good health.
- Scheduling of the cat meals can be done in advance.

- **Problem Statement and Project as a Solution**

  Pets require care, interaction, and monitoring to thrive. Without proper feeding and attention, they can become irritated and cause damage. The Automatic Cat Feeder aims to address these issues by providing timely meals, but plans to incorporate a camera for monitoring were halted due to unavailable hardware and lack of expertise.

- **Aim and Objectives**

  As mentioned before, the primary aim of the Cat Feeder we built is to have a reliable way of feeding the pets, primarily cats in proper interval of time without much human interaction. So, The Automatic Cat Feeder does just that in an efficient manner.

  Some of the objectives can be discussed as follows:

  - To build an automatic pet feeding device which can work without much human interaction.
  - To make the system have a healthy effect on the pet's life lifting the extra weight of the owner thus saving time.
  - To understand concepts of micro-controller, actuator, and Sensors in real life projects and expand upon the knowledge learned.
  - To gather more research data and information for future projects.

- # Background

  - ## System Overview

    The Automatic Cat Feeding system is an IoT project designed to nurture pets' growth without constant owner supervision. It operates by dropping a set amount of cat food at regular intervals, minimizing owner interaction to simply managing the food schedule.This project utilizes three main devices: an Arduino Uno micro-controller, an ultrasonic sensor, and a servo motor, connected with jumper wires. The ultrasonic sensor detects the bowl's fill level, sending signals to the Arduino. Depending on the bowl's status, the Arduino controls the servo motor to dispense food. Additionally, a time interval function ensures food is dispensed every 4-5 hours to prevent overfeeding.

  - ## Design Diagrams

    Flow Chart,

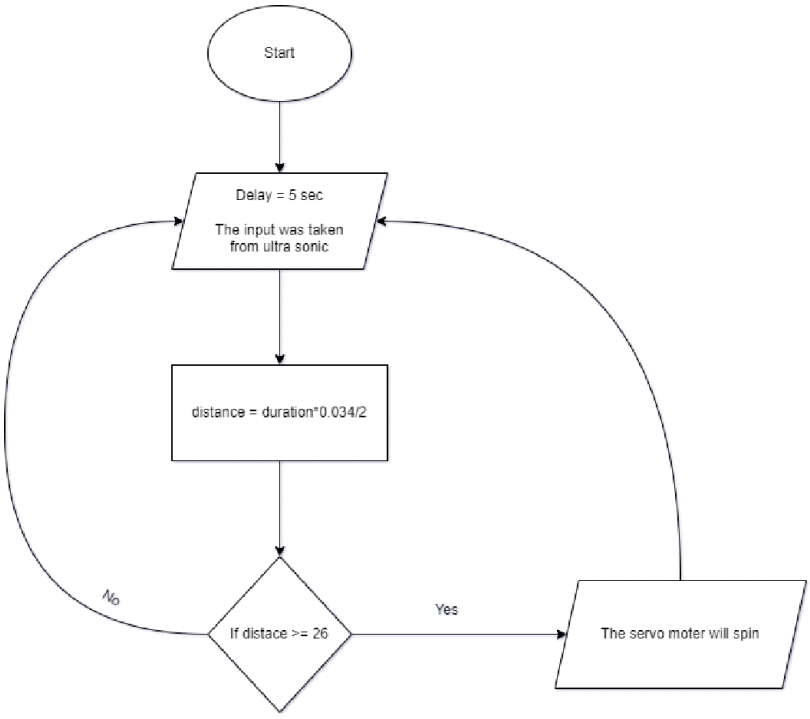

Figure 1 : Flow-Chart

Circuit Diagram,

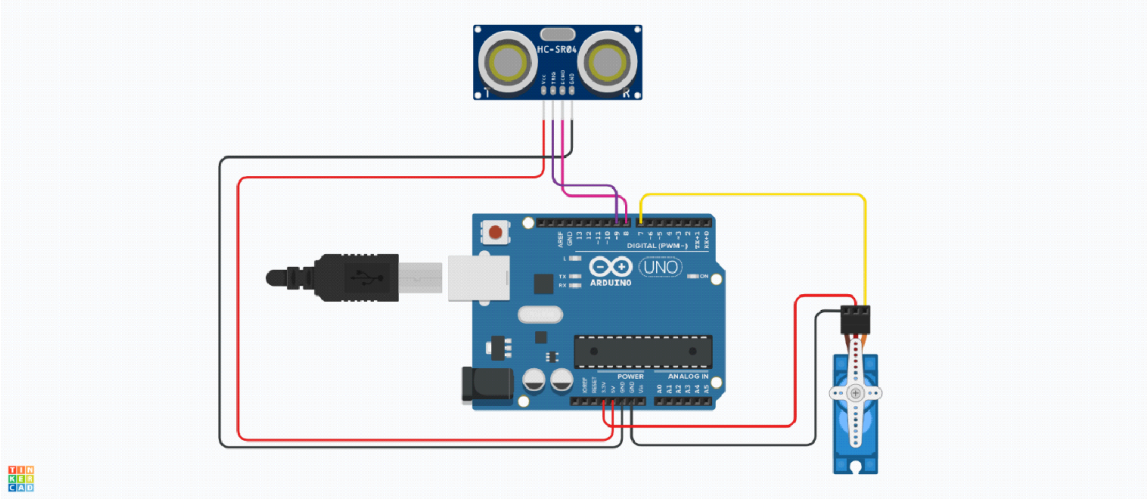

Figure 2 : Circuit Diagram

- **Requirement Analysis**
  - **Hardware Components**
    - **Arduino uno R3**

      The Arduino Uno is a microcontroller board with 20 digital I/O pins, 6 PWM outputs, and 6 analog inputs. It runs on a 16 MHz resonator and can be programmed via USB. The latest version, R3, is widely supported and easy to use for embedded electronics projects.

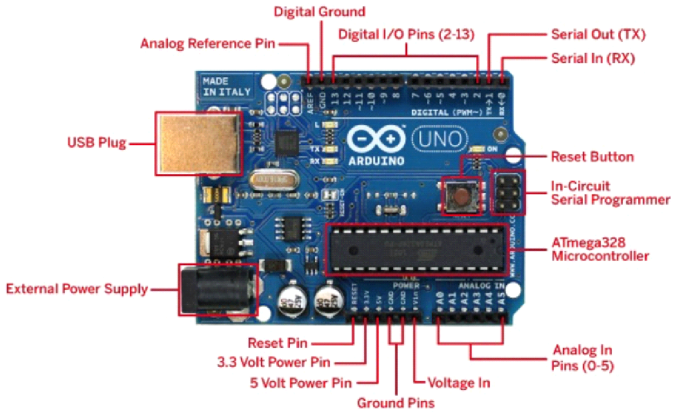

Figure 3 : Arduino Uno R3

- **MG996R Servo motor**

  The High-Torque MG996R Digital Servo offers a compact design with metal gearing, providing exceptional 10kg stalling torque. It's an upgraded version of the renowned MG995 servo, featuring improved shock-proofing, PCB, IC control system, gearing, and motor for enhanced accuracy and performance. It includes a 30cm wire and 3-pin 'S' type female header connector compatible with most receivers.

Figure 4 : MG996R Servo Motor

- **Ultra-sonic sensor**

  An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound. Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).

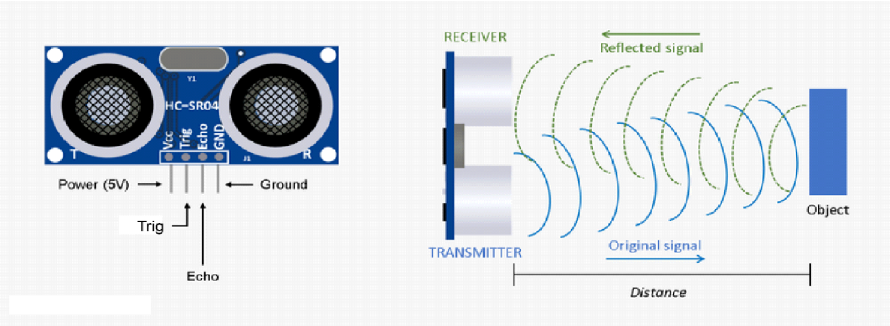

Figure 5 : Ultrasonic Sensor

- **Jumper wire**

  Jumper wires are electrical wires with connector pins at each end. They are used to connect two points in a circuit without soldering. Jumper wires can be used to modify a circuit or diagnose problems in a circuit.

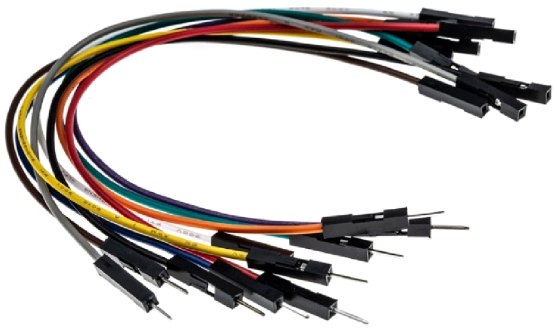

Figure 6 : Jumper Wire

- **Software Components**
  - Arduino IDE

    The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions

and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

- Draw.io

  It helps to create diagrams such as flowcharts, wireframes, charts and so on.

- Ms. Word

  It helps to organize and develop professional quality documents, reports, letters, etc. It is currently being used to finalize the report.

- Tinker cad

  Tinker cad is a web app which allows users to create models that are compatible with 3D printing, a great option for beginners to the technology.

- ## Development

  - ### Design and Planning

    The project was initially designed in Tinkercad, using an Arduino Uno R3, a servo motor, jumper wires, and an ESP-32 Camera chip. However, due to unavailability, the ESP-32 was replaced with an ultrasonic sensor. The circuit connections were established virtually and replicated in real life. While the initial plan involved object detection using OpenCV and the ESP-32, the lack of an FTDI module led to the adoption of the ultrasonic sensor for detecting empty bowls and dispensing food accordingly. Despite the change, understanding the project's concept and mechanism in Tinkercad facilitated the real-life implementation and programming.

- **Resource Collection**

  Several devices and tools were needed to complete the demonstration of this project. The devices were managed from different sources. We wrote an application letter to get the available resource from the IT resource department of the college. The resources which were collected from IT resource department are:

  - Arduino Uno R3
  - Jumper wire
  - Ultrasonic Sensor
  - LEDs
  - Breadboard

  One of the resources, MG996R Servo Motor was collected from a store.

- **System Development**

  Initially, the jumper wires were connected from Ultrasonic senor to Arduino Uno R3 with a total of four jumper wires: Ground, Echo, Trig, and Power.

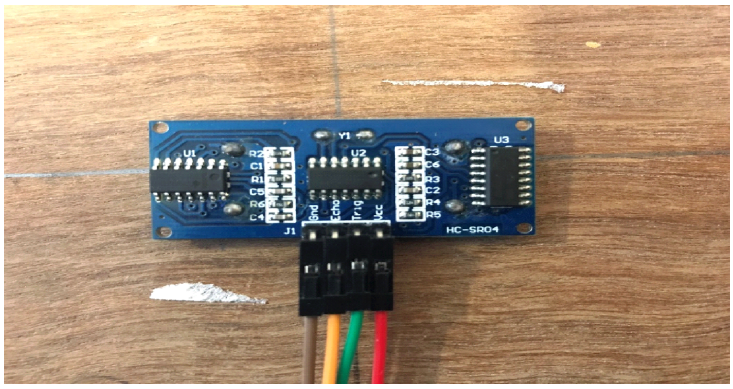

Figure 7 : Connecting wires Into Ultrasonic sensor

The ground from ultrasonic was connected to ground from Arduino, Echo from ultrasonic was connected to pin 9 from Arduino, Trig from ultrasonic was

connected to pin 8 from Arduino and lastly, the Vcc from ultrasonic was connected to ground from Arduino.

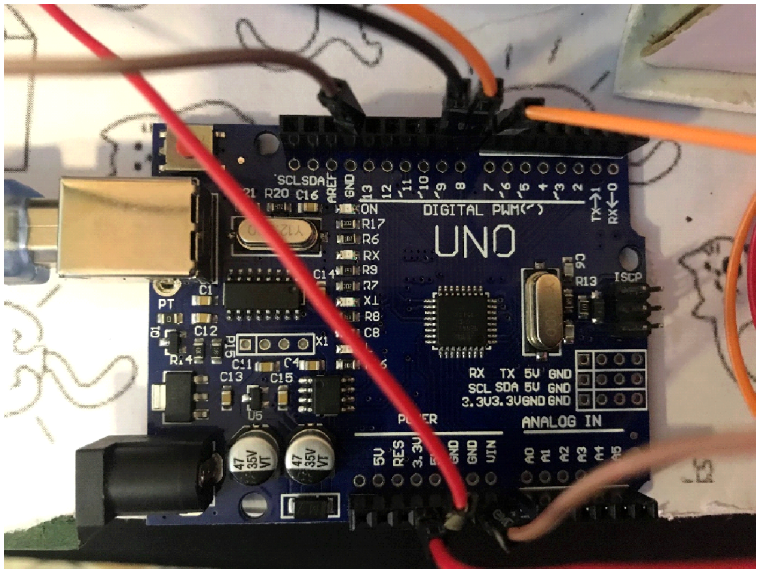

Figure 8 : Connecting wires from both Sensor and Motor

Similarly, the wires from servo motor were connected to pin 7, ground and 3.3 V from Arduino respectively. Lastly, the Arduino UNO R3 was connected to Power supply. Here, we are using power bang.

Figure 9 : Servo Motor

Pin Connection of Each Components

Sensor/Component	Pin Name	Arduino I/O Pin
Ultrasonic Senor	GND Echo Trig Vcc	GND Pin 9 Pin 8 5V
Servo Motor	GND Power Control pin	GND 3.3 V Pin 7

Table 1 - Pin Connection

- **Result and Findings**
  - **Results**

Once assembled, the device was filled with cat food, and a bowl was placed inside to hold the food. With a distance of 30-32 cm between the ultrasonic sensor and the bottom, the sensor detected when the food reached 27 cm, signaling the Arduino to stop the servo motor and halt food dispensing. This ensured the Automatic Cat Feeder accurately provided food to pets as intended.

  - **Findings**

In this section, different test cases are included to show the successful running of the project with a successful output. Following are the test cases:

- **Test – 1**

Test no.	1
Objective	To show the execution of code.
Action	The code was written, verified, and uploaded onto the Arduino with the help of Arduino IDE app.
Expected Result	The code would compile without any error.
Actual Result	The was successfully compiled without a sign of error.
Conclusion	The test was successful.

Table 2 : Test - 1

Output:

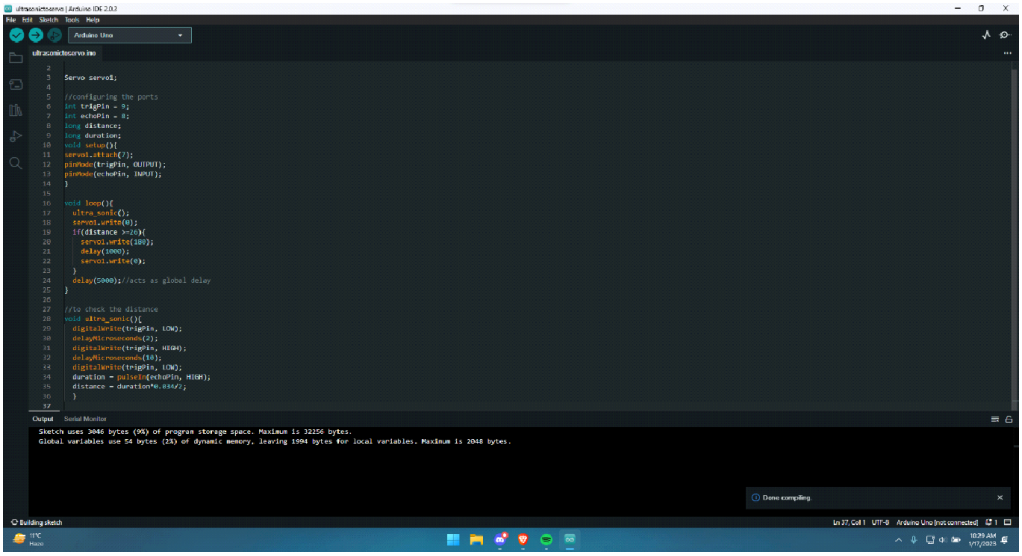

Figure 10 : Code

- **Test – 2**

Test no.	2
Objective	To test if the systems work as intended, If the bowl is empty, food must be dispensed.
Action	An empty bowl is placed in the device.
Expected Result	The food will be dispensed.
Actual Result	The food is dispensed in the bowl.
Conclusion	The test was successful.

Table 3 : Test - 2

Output:

Figure 11 : Food dispensed

- **Test – 3**

Test no.	3
Objective	To test if the device will dispense food when the bowl is already filled.
Action	A filled bowl is placed in the device.
Expected Result	The food will not be dispensed.
Actual Result	The food didn't drop in the bowl.
Conclusion	The test was successful.

Table 4 : Test - 3

Output:

Figure 12 : Food not dispensing anymore

- ## Future Works

  The current system is functional but can be enhanced for efficiency and comfort. By integrating the ESP-32 camera chip, the device can dispense food when pets approach, enabling monitoring and interaction. Adding Wi-Fi connectivity allows remote configuration via the owner's phone, with a notification feature for low food levels. A more compact and open exterior design, with concealed wires and components, ensures space-saving and pet safety.

- ## Conclusion

  Pets have evolved from being solely providers of food to cherished companions in modern society. The Automatic Cat Feeder addresses the stress of forgetting to feed pets, treating them as family members. This project not only solves a modern issue but also provides valuable experience for future endeavors, educating students about IoT systems and their practical applications in daily life.

- ## Appendix

  - ### Appendix A: Source Code

```
Servo servo1;


//configuring the ports
int trigPin = 9;
int echoPin = 8;
long distance;
long duration;
```

```
void setup(){
servo1.attach(7);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
}

void loop(){
 ultra_sonic();
 servo1.write(0);
if(distance >=27){
servo1.write(180);
delay(1000);
servo1.write(0);
}
delay(5000);//acts as global delay
}

//to check the distance
void ultra_sonic(){
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
```

```
        digitalWrite(trigPin, LOW);
        duration = pulseIn(echoPin, HIGH);
         distance = duration*0.034/2;
    }
```

- **Appendix B: Screenshots of the System**

Figure 13 : Inside the device

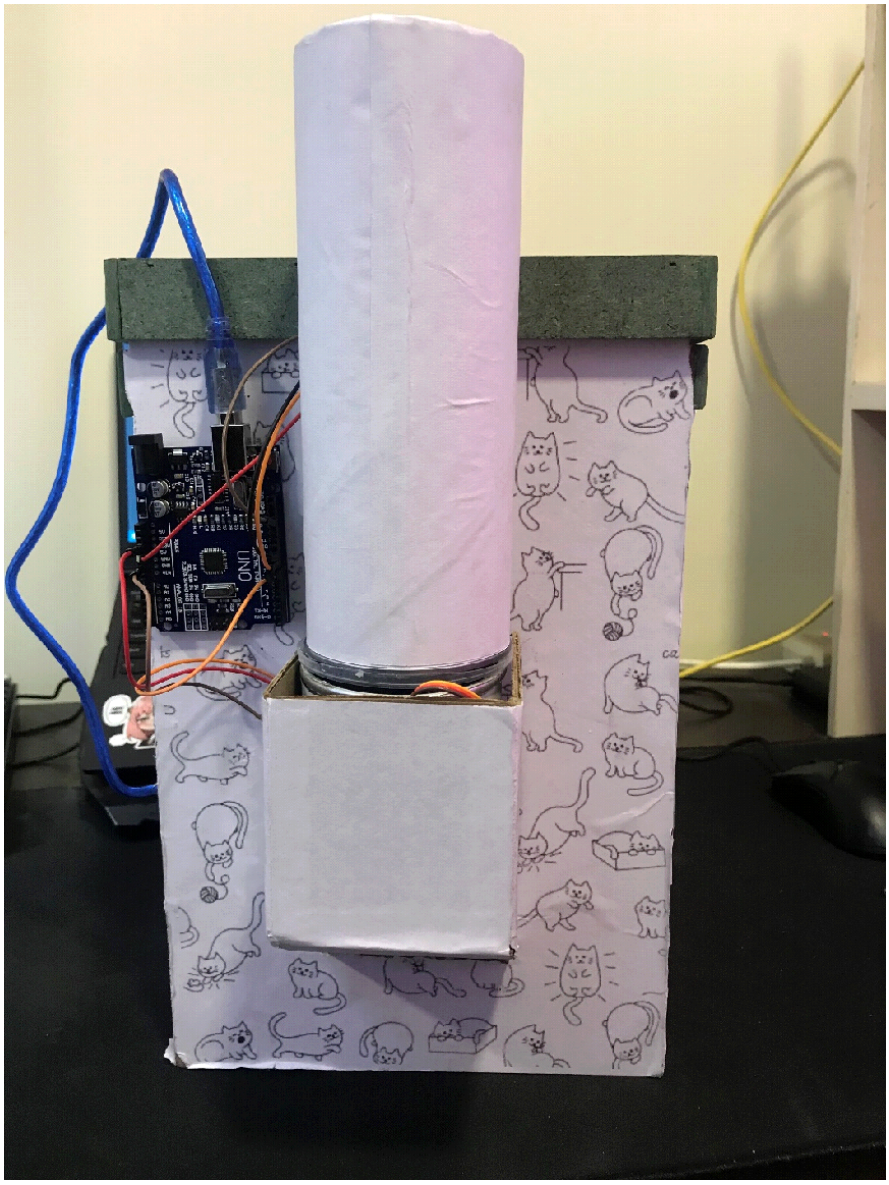

Figure 14 : Behind the device showing all the circuits and components