Fish Feeding System

Team 48

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Video Link:
https://drive.google.com/drive/u/3/folders/18wqlOdvkW2Df1M9t1zTgh25Xeh2IC9HB

Motivation

The motivation behind choosing this project was our interest in aquaculture. We wanted to develop a technology that could improve the well-being of aquatic life, and we felt that an automatic fish feeding system could be a solution to this. We noticed that traditional fish feeding methods were not always effective, and sometimes our fish were not receiving the appropriate amount of food. Therefore, we decided to develop an automatic fish feeding system to address this problem. As a team, we wanted to experiment with different types of technology, such as sensors and microcontrollers, and use them to automate a specific task. Developing an automatic fish feeding system allowed us to do this and create a useful application for aquaculture.

Why did we move from ponds to fish tanks ?

Initially, we thought of developing an automatic fish feeding system for ponds because we believed that it would benefit a larger number of fish and reduce the amount of manual labor required for feeding them. However, as we worked on the project, we realized that a fish tank inside the home would be a more suitable environment to test and refine our automatic fish feeding system. Compared to ponds, fish tanks offer several advantages for testing and using an automatic fish feeding system. For instance:

1. *Greater control over environmental factors:*

   With a fish tank, we can have greater control over the water quality, temperature, and other environmental factors that affect the health and well-being of the fish. This allows us to monitor these variables more closely and make adjustments as needed.

2. *Reduced risk of external factors:*

   In a pond, there are many external factors that can affect the fish, such as predators, weather, and water contamination. By testing the automatic fish feeding system in a controlled environment like a fish tank, we can minimize the impact of these external factors and focus on evaluating the performance of the system itself.

3. *Easier access for maintenance and monitoring:*

   With a fish tank, we can easily access and monitor the fish and the automatic fish feeding system, making it easier to perform maintenance tasks and make adjustments as needed.

Overall, developing an automatic fish feeding system for a fish tank provides a more controlled environment for testing and refining the system, which can help us create a more reliable and effective product.

Literature Survey

After analyzing the three research papers, we can conclude that automatic fish feeding systems have been gaining popularity in aquaculture due to their ability to reduce labor costs and ensure a more controlled feeding process. The proposed systems mainly consist of a storage unit, a feeder unit, and a control system.

The first paper proposed an automatic fish feeder system using a PIC microcontroller application. The device was designed to dispense pellets into the water at a predefined cycle time. The motor speed was used to control the amount of pellets released, and a keypad was provided to the user to adjust the speed based on their requirements. *Published in 2012 IEEE Control and System Graduate Research Colloquium*

The second paper presented an automatic fish feeding machine that can dispense dried fish food in various forms into fish tanks or ponds in a controlled manner for a stipulated time. The feeder was controlled by a digital timer and had a feeding rate of 250g/min. The feeder could be adjusted to the desired height and conveniently moved around to be positioned adjacent to the pond or tank. Published as *Development of Automatic Feeding Machine for Aquaculture Industry by S. J. Yeoh, F. S. Taip* , J. Endan, R.A. Talib and M.K. Siti Mazlina*

The third paper designed, fabricated and tested an automatic fish feeder system that was powered electrically by a one-horsepower motor. The system had a hopper carrying capacity of 5.5kg/volume of hopper with a variable discharging chute. The timer was designed with a 24-hour time step at the user's specified discharge duration. The test results showed that 85.5kg of feeds were evenly distributed across the pond with less than 3% feed loss. *Development of an automatic fish feeder 1 1 2 2 Ozigbo Emmanuel, Anyadike Chinenye, Gbadebo Forolunsho, Okechukwu Richardson 2 and Kolawole Peter*

Overall, the literature survey reveals that automatic fish feeding systems have been developed to improve the aquaculture industry's productivity by reducing labor costs and ensuring a more controlled feeding process. The proposed systems have different features, including motor speed control, digital timers, and adjustable feeders.

Project Scope

Based on the research and literature survey conducted, the scope of our project will be to design and develop an automatic fish feeder system for indoor fish tanks. The device will incorporate mechanical and electrical systems to control the feeding activity of fish, using a microcontroller to manage the entire process. The pellets will be stored in a container, dispensed through a motor and released into the fish tank according to a predetermined feeding schedule. The device will also have an adjustable speed control for the motor to enable different feeding rates based on the user's preference. Additionally, we will ensure that the device is easy to use, disassemble, and clean to make maintenance a hassle-free process. Overall, the project aims to provide a convenient and cost-effective solution for fish feeding that will make it easier for people to care for their fish while minimizing labor costs.

Project Roadmap/timeline

ID	Name	Start Date	End Date	Duration	Progress %	Dependency	Resources	Color
1	Introduction	Jan 06, 2023	Jan 13, 2023	6 days	100			
2	Finalizing Problem Statement	Jan 13, 2023	Jan 20, 2023	6 days	100			
3	Research(Product Development)	Jan 20, 2023	Feb 03, 2023	11 days	70		Team Member 1,Team Me...	
4	knowing About components(BOM)	Feb 03, 2023	Feb 10, 2023	6 days	90		Team Member 1,Team Me...	
5	Working of Components	Feb 10, 2023	Feb 17, 2023	6 days	80		Team Member 1,Team Me...	
6	Designing a 3D model	Feb 17, 2023	Feb 24, 2023	6 days	85		Team Member 1,Team Me...	
7	Circuit Design online	Feb 24, 2023	Mar 03, 2023	6 days	0		Team Member 1,Team Me...	
8	Get components	Mar 03, 2023	Mar 10, 2023	6 days	0		Team Member 1,Team Me...	
9	Design a 3D product	Mar 10, 2023	Mar 31, 2023	16 days	0		Team Member 1,Team Me...	
10	Testing Product	Mar 31, 2023	Apr 07, 2023	6 days	0		Team Member 1,Team Me...	
11	recreating Feedbacks	Apr 07, 2023	May 01, 2023	17 days	0		Team Member 1,Team Me...	

Here is a revised timeline for a 12-week project based on the tasks you mentioned:

Week 1-2: Defining the project topic, conducting research on the topic, and reading previous papers related to the topic.

Week 3-4: Analysis of the topic, generating ideas, finding possible methods, and exploring different design options.

Week 5-6: Identifying the components required for the project, researching and understanding how each component works, and creating a bill of materials.

Week 7-8: Developing an MVP (minimum viable product) to test the feasibility of the project, creating a 3D model design, and designing the circuitry.

Week 9-10: Hardware design and development, writing code for the Arduino and motor, and integrating software and hardware.

Week 11: Testing the project, collecting feedback, and reworking on the model and hardware as needed.

Week 12: Finalizing the report, summarizing the findings and conclusions, and presenting the project.

Team Members Roles and Responsibilities

Bandigari Mahidhar Reddy(CS20B1091),
Sapavat Jagan(EC20B1012):

Worked collaboratively on research and product selection. Circuit building and code optimization for all sensor modules. Calculating dissolved oxygen in a cost effective manner by abusing the constants of the room atmosphere. Chips selection and sensor selection was done accordingly. Procurement of these components. Designing a circuit model by connecting appropriate sensors , modules.

Jasti Sai Rushik(CS20B1065),
Ajay(ME20B1061):

Modeling and developing a confined 3d model in various softwares (blender, fusion 360). THe core part of our development was the rotating cylinder for dropping food. Selection of materials and hardware procurement. Device building/ integrating our 3d model with the circuit board.

Methodology

After finalizing the topic automatic fish feeding system , we defined it scope we gone through previous papers about their methods used , components , working principles , designs of products.In designing the feeder, several criteria need to be determined; these include the characteristics of the fish, types and sizes of fish feed, and functions of the feeder. For this purpose, data and information have been collected to gain a baseline for the design. Factors or problems influencing the process have also been considered to ensure the efficiency of the machine. The device should be simple, compact, and efficient in operation. We created sketching using autodesk , blender softwares , and circuits from online softwares.

The basic point of this machine is to provide food to fish from time to time and it should be adjustable by the user , how much food needs to take each day , as it won't be constant for all fishes for all days differs from type of fish and as fish grows intake of food changes. The challenge is to create a machine that should be compatible , less cost with good efficiency . it should monitor the fish tank , food , dissolved oxygen , humidity , temperature in the fish tank and alerts users whenever necessary.
We gather all the components needed like arduino , N20 gear motor , ph sensor , humidity , temperature(DHT11) . Using arduino software we monitor all the data using code. The food we provide is placed in slant position so that due to gravity food will come down in slant , in one corner there is cylindrical shape object which collects food while rotating and drops at other half of rotation , it is monitored by ardiuno.As space efficiency also consider we divides a box into two components of 1:2 ration so that smaller part is for food and bigger area is to place circuits.

Bill of materials

Temperature sensor :

Link:
https://www.amazon.in/Robodo-Electronics-DHT11-Temperature-Raspberry/dp/B00BOMEO5U?th=1
Cost : $214
Model : DHT11 temperature and humidity sensor

Arduino :

Link :
https://www.amazon.in/Arduino-Uno-ATmega328P-USB-Cable/dp/B01LCN8IRK/ref=sr_1_4?adgrpid=69733280520&ext_vrnc=hi&hvadid=333661318970&hvdev=c&hvlocphy=1007809&hvnetw=g&hvqmt=b&hvrand=15953706842169549712&hvtargid=kwd-295740790969&hydadcr=26432_1900809&keywords=a
Cost : 1087
Model name : Arduino Uno R3 ATmega328P with USB Cable

Bread board :

Link : https://www.amazon.in/Robo-India-MB-102-Breadboard-Solderless/dp/B01ID6P7A0
Cost : 230
Model : Robo India Breadboard MB102 830 Points Solderless Prototype PCB Breadboard

N20 DC MOTOR :

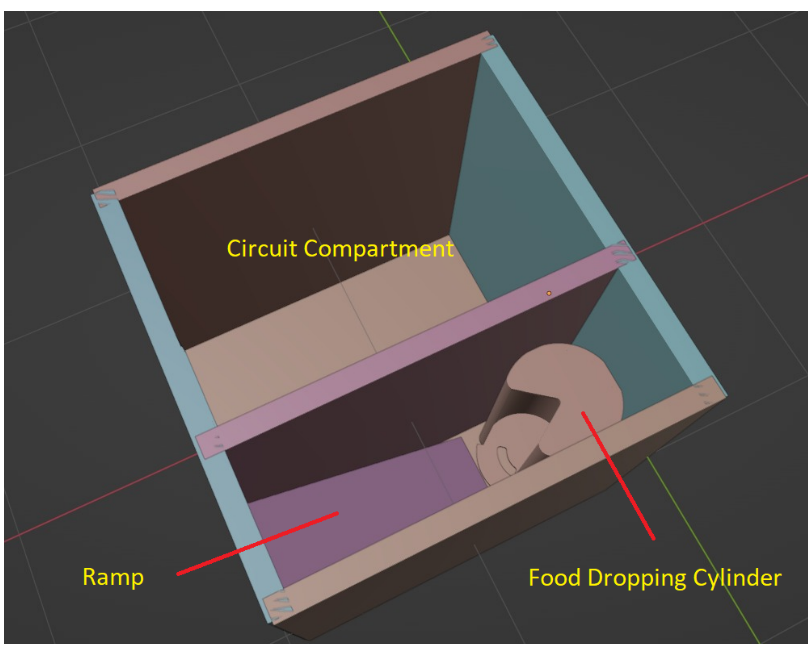
link :
https://www.amazon.in/dp/B0977Q3N6B?ref_=cm_sw_r_apann_dp_1QHVKPDYCFQ5ZTG5HW9C
cost : 445
model : Techtonics N20-12V-60 RPM Micro Metal Gear-box DC Motor

PH SENSOR

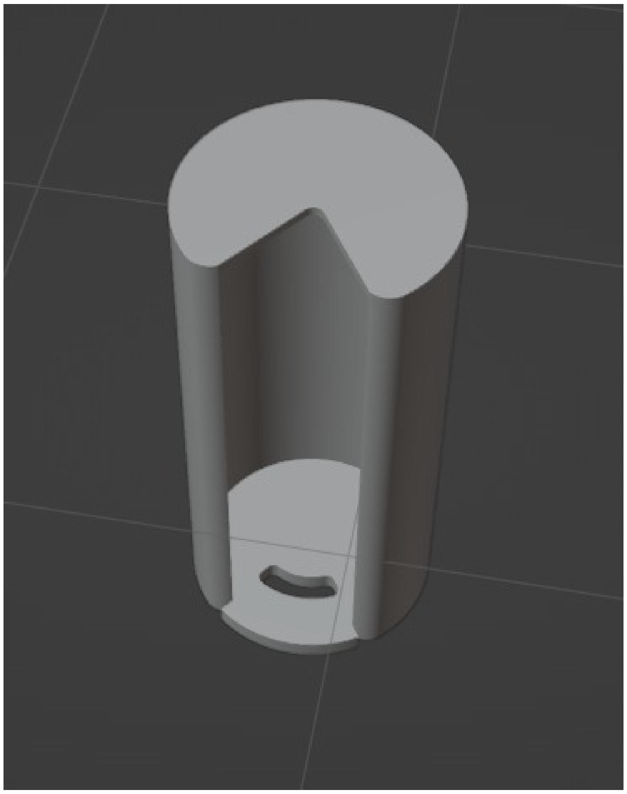
Link : https://robu.in/product/liquid-ph-value-detection-sensor-for-arduino/
Cost : 802
Model : Liquid pH Value Detection Sensor for Arduino

PH PROBE
Link :
https://robu.in/product/electrode-probe-for-liquid-ph-value-detection-sensor-module/
Cost : 680
Model : Electrode Probe for Liquid pH Value Detection Sensor Module

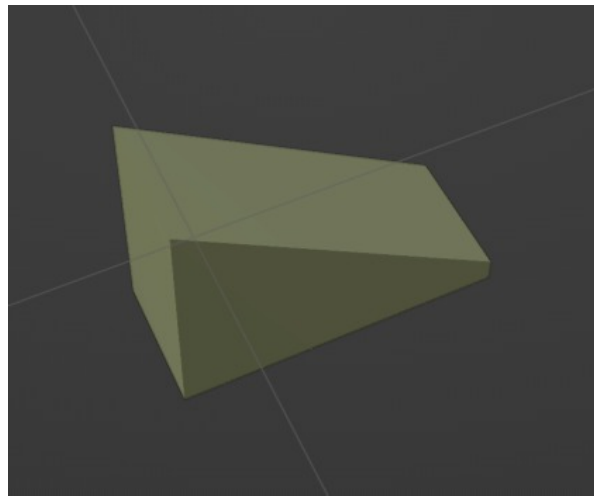
CAD Model



Container



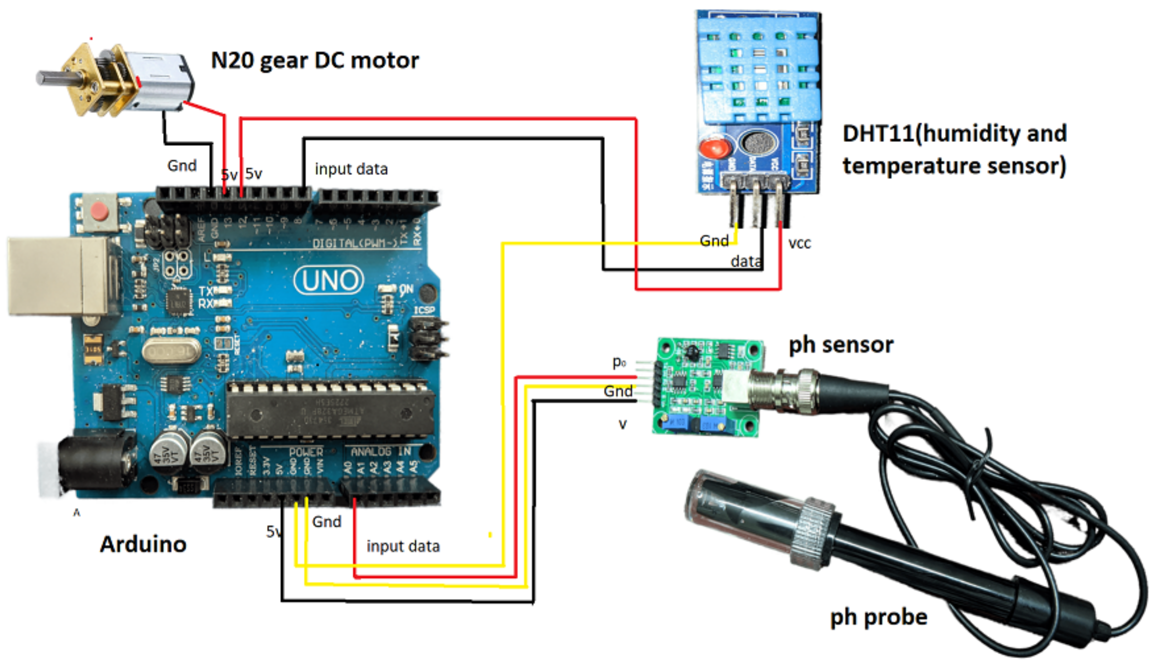
Food dropper



Ramp

This is the main component of our CAD model. We have come up with an innovative way, where the food comes out of the cylinder only if it rotates. If the cylinder stops rotating despite its final state, food will stop falling. This helps it to not misbehave in times of power cuts. This also eases up the coding of circuits.

Circuit Design :



Circuit Design

In the above circuit pin 12 , 13 is given high initially that is 5v is supplied to both . As we need to operate from time to time we toggle the motor pin from high to low , low to high. Humidity temperature sensor is connected to ground and 5v to create a voltage difference so that it works , to collect the data from DHT11 we are using port 8. For ph sensor similarly to create a voltage difference we are using 5v and Gnd , to get input data we are using port A0

Code :

```
#include <dht.h>         // Include library
#include <Wire.h>
#include <Adafruit_GFX.h>
#include <Adafruit_SSD1306.h>
#define outPin 8         // Defines pin number to which the sensor is
connected


float calibration_value = 25.7 ;
unsigned long int avgval;
```

```
int buffer_arr[10],temp;

float ph_act;

dht DHT;                // Creates a DHT object

void setup() {

  Wire.begin();
  Serial.begin(9600);
  pinMode(outPin, OUTPUT);
  pinMode(13, OUTPUT);
  pinMode(12 , OUTPUT);
}

void loop() {

 digitalWrite(13, HIGH); // set pin 13 high
  // wait for 1 second

digitalWrite(12 , HIGH);

  int readData = DHT.read11(outPin);

  float t = DHT.temperature;        // Read temperature
  float h = DHT.humidity;           // Read humidity

  Serial.print("Temperature = ");
  Serial.print(t);
  Serial.print("°C | ");
  Serial.print((t*9.0)/5.0+32.0);        // Convert celsius to fahrenheit
  Serial.println("°F ");
  Serial.print("Humidity = ");
  Serial.print(h);
  Serial.println("% ");
  Serial.println("");
 delay(5000);
    digitalWrite(13, LOW); // set pin 13 low
 avgval=0;
 for(int i=2;i<8;i++){
```

```
   int temp = analogRead(A0);
   Serial.print(temp);
   Serial.print(" ");
   avgval+=temp;


    delay(30);
      // avgval+=buffer_arr[i];
 }

 float volt=((float)avgval/6)*(5.0/1024);
 Serial.println("\nvoltl: ");
 Serial.println(volt);

Serial.println("pH Val: ");

float ph_act = ph(volt);
Serial.println(ph_act);


long DO  ;
long T = t * t ;
DO  = 8.3 * (14.62 - 0.4119*t + 0.008132*(T) - 0.0003125*(T*t)) ;
Serial.println("DO Val: ");
Serial.println(DO);

  delay(2000); // wait two seconds
}

float ph (float voltage) {
    return  ((voltage) / 5)*14;
}

//other information on dissolved oxygen

// float a = 0.287;
// float b = 3.319;
// float c = 1.53;
// float PSS = 0.0080 * sqrt((42.914*(4005*t / (t + 15)))) ;
// float Salinity = 1.80655 * PSS;
```

```
// float saturation_concentration = 14.62 - 0.3977 * t - 0.00058 * (pow(t
, 2)) + (34.494 - 0.0176 * t) * (Salinity / 1000);
// long DO = a *saturation_concentration * (pow(10 , (b * ph_act - c)));
// Serial.println("Salinity :  ");
// Serial.println(Salinity);
// Serial.println("saturation concentration: ");
// Serial.println(saturation_concentration);
// The calculation of dissolved oxygen (DO) in water is influenced by
several factors, including temperature, pressure, salinity, and
atmospheric conditions. The atmospheric conditions that affect DO are
mainly the atmospheric pressure, temperature, and relative humidity. The
pH of water also plays a role in DO levels, but it is not directly related
to the atmospheric conditions.

// To calculate the DO level in water based on the atmospheric conditions,
you can use the following formula:

// DO (mg/L) = [Atm. Pressure (mmHg) / 760] * [Oxygen Saturation at Water
Temp. (mg/L)] * [Percent Saturation at Atmospheric Conditions]

// where:

//     Atm. Pressure: the atmospheric pressure in millimeters of mercury
(mmHg) at the location where the water sample was taken
//     Oxygen Saturation at Water Temp.: the maximum amount of dissolved
oxygen that water can hold at a given temperature (mg/L). This value can
be obtained from a dissolved oxygen table or calculator.
//     Percent Saturation at Atmospheric Conditions: the percentage of
dissolved oxygen saturation in water at the given atmospheric conditions.
This value can also be obtained from a dissolved oxygen table or
calculator that takes into account the temperature, pressure, and relative
humidity of the atmosphere.

// The pH of water can also affect the DO level, as water with a higher pH
tends to have a lower DO level. However, the effect of pH on DO is
relatively small compared to the effect of temperature, pressure, and
atmospheric conditions. To calculate the effect of pH on DO, you can use
the following formula:

// DO (mg/L) = DO at pH 7.0 (mg/L) * 10^(pH-7)
```

```
//     DO at pH 7.0: the dissolved oxygen level at pH 7.0, which is typically around 8-9 mg/L at standard conditions.
```

Key takeaways/learnings from course

1. *Learnings specific to the project:*
    - Understanding the importance of prototyping as a way to test and validate design concepts before committing to a final solution.
    - Learning different prototyping methods such as 3D printing, and electronics prototyping.
    - Understanding the role of user feedback in the iterative design process and incorporating it into the prototype.
    - Understanding the importance of testing the prototype in a realistic environment to identify and address any issues before finalizing the design.
2. *General learnings from the course:*
    - Learning about different design methodologies such as Design Thinking, Lean Startup, and Agile.
    - Understanding the importance of user-centered design and incorporating user feedback into the design process.
    - Learning about different types of testing such as usability testing, A/B testing, and acceptance testing.
    - Understanding the importance of documentation throughout the design process, including design briefs, design specifications, and user manuals.

Overall, the course has provided a valuable framework for approaching design and prototyping projects, emphasizing the importance of user feedback, testing, and documentation in the design process.

Future scope

The future scope of your project can be divided into short-term and long-term goals. Here are some potential ideas:

Short-term goals:

1. *Integration with mobile app*: You could create a mobile app that connects to the system and allows users to monitor their stored food remotely. This could include push notifications, real-time updates, and data visualization.
2. *Automatic food rotation*: Currently, you rotate the food manually using a motor. In the future, you could integrate a system that automatically rotates the food at regular intervals. This could be based on time, temperature, or other factors.
3. *Machine learning:* As you collect more data on the food storage environment, you could use machine learning algorithms to analyze the data and make predictions. For example, you could use predictive analytics to determine the best time to rotate the food or alert users when the food is about to spoil.

Long-term goals:

1. *Scaling up*: Currently, your system is designed for small-scale food storage. In the future, you could explore the possibility of scaling up the system to store larger quantities of food.
2. *Commercialization:* If your system proves to be successful, you could explore the possibility of commercializing it. This could involve partnering with a manufacturer or distributor to produce and sell the system to consumers or businesses.
3. *Integration with other systems:* Your system could be integrated with other systems, such as smart homes or smart cities, to create a more interconnected and intelligent environment. For example, your system could receive data from weather sensors to adjust the temperature and humidity levels in real-time.

Conclusion

In conclusion, our project aimed to design and develop a food storage system that can maintain optimal environmental conditions for food preservation. We have successfully achieved our goal by designing a system that can monitor and control the temperature, humidity, pH, and dissolved oxygen levels of the storage unit using Arduino-based sensors and actuators. The system is also equipped with an N20 motor that can rotate the food inside the storage unit to prevent spoilage.

Throughout the project, we learned the importance of proper planning and project management in ensuring the success of a complex project. We also developed technical skills in designing and assembling electronic circuits, programming Arduinos, and 3D modeling.

The project has a potential application in both residential and commercial settings, such as homes, restaurants, and food storage facilities. Further improvements could be made to the system, such as integrating a more advanced monitoring system, adding remote control and monitoring capabilities, and expanding the storage capacity.

Overall, we are satisfied with the outcome of the project, and we believe that it has the potential to make a significant impact on the food storage industry.

References/citations

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