Department of Electronic and Telecommunication Engineering

University of Moratuwa

Semester 4 – Intake 2020

Development of an Automatic Water Dispenser for pets

Final Report

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Abstract

In the modern world, pet owners often face challenges in providing constant care and attention to their beloved companions due to their busy lifestyles. A significant issue arises when it comes to ensuring a continuous supply of clean water for pets, particularly during prolonged absences. To address this concern, we present a groundbreaking solution: an Automatic Water Dispenser for Pets. This innovative device is designed to detect the presence of pets and dispense water on demand, ensuring they have access to fresh water whenever they need it. The dispenser's advanced filtration system guarantees that the water remains clean and safe for consumption, while any unused water is efficiently redirected back to the main reservoir for recycling. Furthermore, the system is equipped with alerts, promptly notifying pet owners to refill the water container when it becomes depleted. Thus, the objective of this report is to present a comprehensive solution that offers long-lasting access to clean water for pets, while promoting energy efficiency, cost-effectiveness, and accessibility to cater to the needs of both individual and institutional pet care scenarios.

1. Problem Definition

1.1. Introduction to the problem

The significance of pets in people's lives remains undeniably profound, yet the demands of contemporary busy schedules have left pet owners overwhelmed, leading to a concerning neglect of their pets' wellbeing. Furthermore, in a world where individuals often live in solitude, the desire for companionship drives a growing interest in adopting pets. However, potential pet adopters are frequently discouraged by the substantial costs and time commitment required for proper pet care.

In the absence of pet owners for extended periods, the conventional method of providing water through bowls proves inadequate, as pets are left to drink stagnant and potentially contaminated water for days or face dehydration due to insufficient water supply. The challenge extends beyond individual pet owners, with institutions like animal shelters, pet shops, and veterinary clinics struggling to ensure timely access to clean water for many animals in their care.

Though water fountains exist in the market, their reliance on continuous electricity raises concerns about sustainability and affordability. To address these multifaceted challenges, a pressing need arises for an innovative solution capable of providing pets with a constant supply of clean water for extended periods without depleting vital resources or imposing significant financial burdens on pet owners and institutions alike.

1.2. Need Analysis

The need analysis for the Automatic Water Dispenser for Pets, based on discussions and interviews with key stakeholders including **pet owners**, **veterinarians**, and **pet shop owners**, revealed the following essential requirements:

- **Convenience for Busy Pet Owners**: With modern lifestyles becoming increasingly hectic, pet owners are in dire need of a solution that alleviates the burden of constantly providing fresh water to their pets. The Automatic Water Dispenser offers a seamless and automated water supply, catering to the needs of busy pet owners who may be absent for extended periods.

- **Enhanced Pet Wellbeing**: The wellbeing of pets is a primary concern for all stakeholders. Ensuring access to clean and uncontaminated water is essential for maintaining the health and vitality of pets. The dispenser's filtration system, which purifies and recirculates water, guarantees that pets can always drink safe and fresh water.

- **Addressing Loneliness**: In an era where individuals often experience loneliness due to living alone, pets serve as valuable companions. The Automatic Water Dispenser supports this aspect by facilitating pet adoption, offering a solution for potential pet owners who seek companionship but are hesitant due to the time and effort required for pet care.

- **Efficiency for Institutional Pet Care**: Stakeholders involved in managing animal shelters, pet shops, and veterinary clinics face the challenge of providing water to a large number of animals. The Automatic Water Dispenser addresses this need by offering a consistent and efficient water supply system for institutional pet care settings.

- **Sustainability and Energy Conservation**: In the pursuit of a greener and more sustainable approach, stakeholders expressed the importance of an energy-efficient solution. The dispenser's ability to minimize electricity consumption and conserve water through recycling aligns with this critical need.

- **Affordability and Accessibility**: Stakeholders emphasized the significance of an affordable solution that is accessible to a wide range of customers. Cost-effective implementation of the Automatic Water Dispenser allows for broader adoption and benefits both individual pet owners and institutional users.

- **User-Friendly Interface and Maintenance**: A user-friendly design, simple installation, and easy maintenance were identified as essential attributes for the success of the product. Stakeholders highlighted the importance of clear instructions and guides to ensure seamless usage and upkeep of the dispenser.

- **Real-Time Alerts and Monitoring**: The need for timely alerts to refill the water container when it runs low was emphasized. Real-time monitoring and notifications enable pet owners and institutional caregivers to address water supply needs promptly, ensuring pets' continuous access to water.

In conclusion, the need analysis indicates that the Automatic Water Dispenser for Pets effectively addresses the pressing concerns of key stakeholders. By offering convenience, improved pet wellbeing, and sustainability, the product presents a comprehensive solution that aligns with the interests and requirements of pet owners, veterinarians, and pet shop owners alike.

2. Market Goals

- **Competitive Pricing and Affordability**: Offer competitive price of Rs.20 000 that ensures the product's accessibility to a broad customer base, appealing to both price-conscious individual pet owners and budget-conscious institutional buyers.

- **Penetration and Adoption**: The primary market goal is to achieve widespread penetration and adoption of the Automatic Water Dispenser in the pet care market, targeting both individual pet owners and institutional customers, such as animal shelters, pet shops, and veterinary clinics.

- **Market Leadership**: Establish the product as a market leader by offering a superior and innovative solution that outperforms existing water dispensing options, positioning it as the go-to choice for pet owners and caregivers seeking an automated, energy-efficient, and cost-effective solution.

- **Brand Awareness and Trust**: Build strong brand awareness and trust among potential customers through effective marketing strategies, testimonials, and positive reviews, highlighting the product's benefits and reliability.

- **Market Expansion**: Explore opportunities for market expansion by targeting new geographical regions and demographics, recognizing the growing global demand for pet care solutions, especially in urban areas with busy pet owners.

- **Customer Satisfaction and Retention**: Focus on customer satisfaction by continuously improving the product's functionality, durability, and user experience, leading to increased customer retention and loyalty.

- **Partnerships and Distribution Channels**: Forge strategic partnerships with pet supply stores, veterinarians, and online retailers to expand the product's distribution channels, making it readily available to potential customers.

- **Regulatory Compliance**: Ensure the product complies with all relevant safety and environmental regulations, obtaining necessary certifications to instill confidence in customers and regulatory bodies.

- **Sustainable Growth and Profitability**: Achieve sustainable growth and profitability in the market, balancing product quality, cost-effectiveness, and scalability to create a strong foundation for the company's long-term success.

- **Customer Education**: Emphasize the importance of the Automatic Water Dispenser's features, benefits, and environmental impact through educational content, tutorials, and guides to empower customers to make informed purchasing decisions.

By pursuing these market goals, the Automatic Water Dispenser for Pets aims to become a leading and trusted solution in the pet care industry, meeting the needs of both pet owners and institutional customers while promoting responsible and sustainable pet care practices.

3. Design Process

3.1. Determining the features

To address the requirements outlined in the need list, the following components and design considerations are proposed:

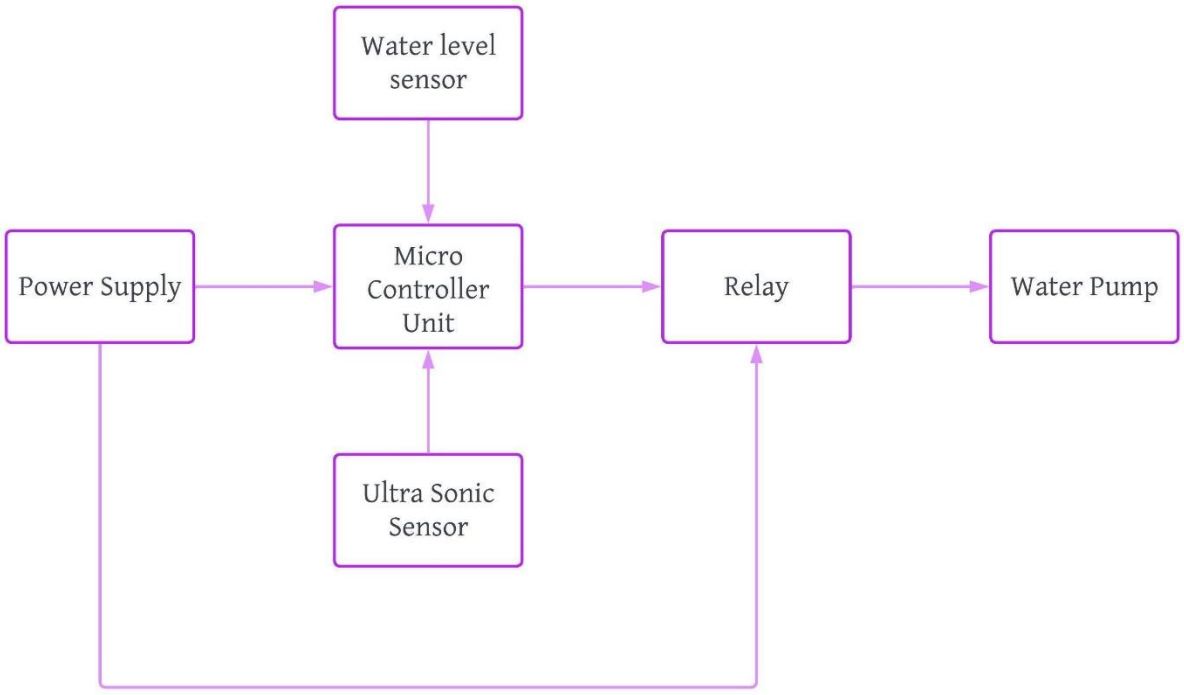
- **Ultra Sonic Sensor**: The Automatic Water Dispenser for Pets incorporates an advanced Ultra Sonic Sensor, enabling the product to detect the presence of the animal with precision. This feature directly addresses the need for convenience for busy pet owners, ensuring that water is dispensed only when the pet is present, eliminating unnecessary water wastage and optimizing the dispenser's efficiency.

- **Water Level Sensor**: With its integrated Water Level Sensor, the dispenser intelligently monitors the water level within the container. This crucial feature fulfills the need for enhanced pet wellbeing, as it prevents pets from drinking contaminated water or facing dehydration by alerting pet owners when the water level is low. Additionally, for institutional settings, the sensor helps manage water supply efficiently, benefiting pet shops, vet clinics, and animal shelters, where the proper care of numerous animals is essential.

- **Buzzer Alert System**: To meet the requirement of real-time alerts and monitoring, the Automatic Water Dispenser is equipped with a Buzzer Alert System. When the water level reaches a critical point, the buzzer promptly notifies pet owners to refill the container. This not only ensures that pets always have access to fresh water, but also addresses the need for sustainability, as it minimizes water wastage and helps pet owners conserve resources responsibly.

3.2. Block Diagram

The proposed block diagram outlines the system's functionality and critical components.



3.3. Functionality

The functionality process of the product is as follows:

- **Water Level Sensing:**
  The water level sensor continuously monitors the water level within the main reservoir. When the water level drops to a low point, the system activates a buzzer, promptly alerting the pet owner to refill the main reservoir, ensuring that the dispenser is always ready to meet the needs of the pets.
- **Dispensing Water:**
  Upon refilling the main reservoir with sufficient water, the buzzer deactivates, signaling that the dispenser is ready for use. When the ultra-sonic sensor detects the presence of an animal, such as a pet, the system triggers the microcontroller to activate the motor.
- **Water Pumping:**
  The motor activates the water pump, facilitating the flow of water to the drinking plate positioned above. Pets can access a steady stream of clean water, promoting their wellbeing and ensuring they have access to fresh water whenever they need it.

- **Intelligent Water Recycling:**
  As the pet leaves the drinking area, any remaining water on the plate flows back into the dispenser through a filtration process. The filtration system efficiently cleans and purifies the water, removing impurities and contaminants, making it safe for future consumption.
- **Return to Main Reservoir:**
  Filtered water then returns to the main reservoir, where it is stored and ready for the next use. This process ensures that water is conserved and utilized responsibly, addressing concerns of water wastage and promoting sustainable pet care practices.

4. Implementation

4.1. Components Selection

Selected Components for Successful Implementation of the Automatic Water Dispenser for Pets:

1. Atmega328P Microcontroller: The Atmega328P serves as the brain of the system, controlling and coordinating the various components. It is connected to water-level sensor and ultrasonic sensor, which detect water level and pet's presence near the water bowl, respectively. When ultrasonic sensor detects presence of the pet nearby, it provides a signal to Atmega328P. The Atmega328P program compares the received signal with the programmed value and gives signal to its digital output to operate (energize) relay if the programmed conditions are fulfilled. Otherwise, the relay remains de-energized. Data Sheet

2. HC-SR04 Ultrasonic Sensor: The HC-SR04 ultrasonic sensor detects the presence of animals in proximity to the dispenser. The ultrasonic transmitter and receiver detect the presence of an object 2cm to 400cm away. Its ultrasonic transmitter produces 40kHz signal and the receiver collects the reflected signal if the object is within range. Data Sheet

3. SEN18 Water Level Sensor: This sensor has ten exposed conducting tracks, of which five alternate strips are power tracks and the other five are sensing tracks. When the sensor is submerged in water (vertically), bridges are created between the five pairs of power and sensing tracks due to water's conductivity. Thus, the sensor works like a variable resistor whose value at the sensing pin changes with the change in water level. The value is high when the water level is high and low when water level is low. The sensor can be powered with 3.3V or 5V on-board DC supply. The SEN18 water level sensor is crucial for monitoring the water level in the main reservoir. It enables the system to detect when the water level is low, triggering an alert for the owner to refill the reservoir. User Manual

4. 5V Relay Module: The 5V relay module acts as a switch to control the 12V submersible water pump. It allows the microcontroller to activate and deactivate the pump efficiently, controlling the flow of water to the drinking plate. Data Sheet

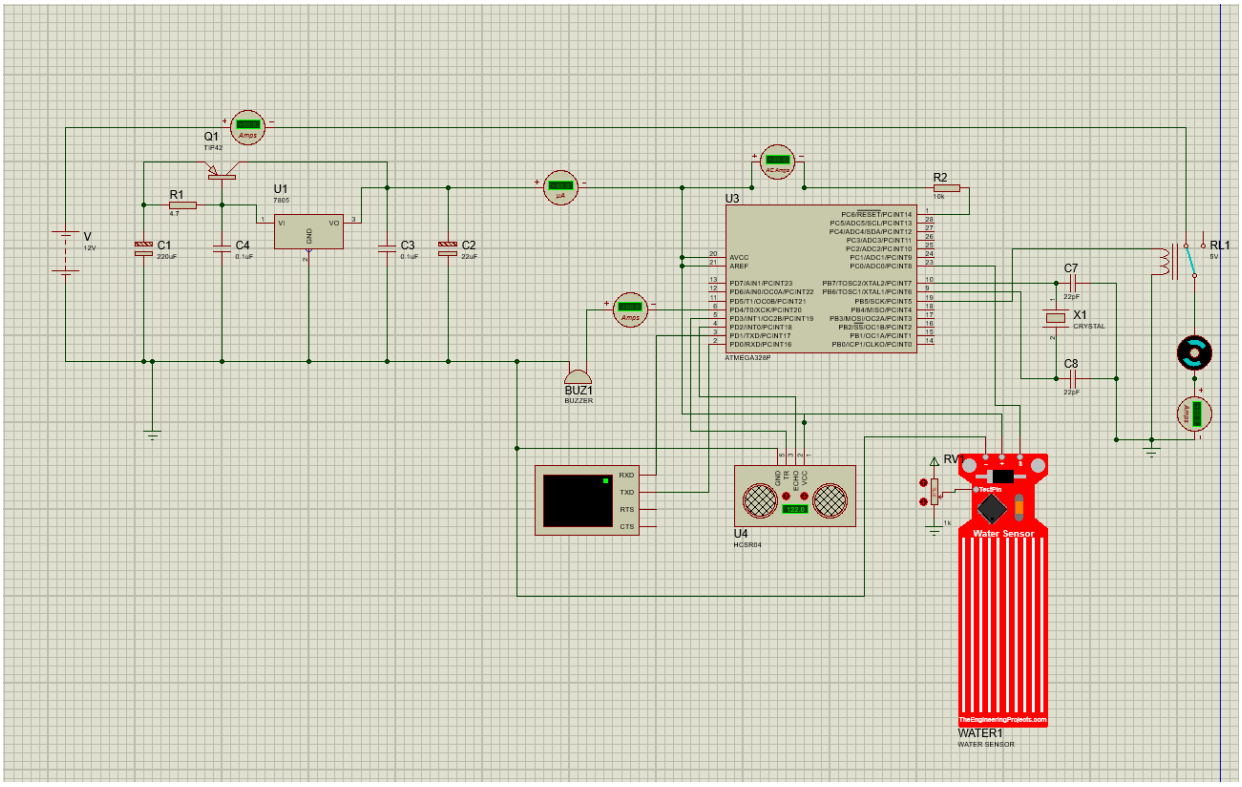
5. 12V/2A Power Adapter: The 12V/2A power adapter converts AC 230V to DC 12V and supplies the necessary power to the system, ensuring smooth and reliable operation of all components. It provides sufficient power for the microcontroller, sensors, relay module, and water pump.

6. 12V Submersible Water Pump: The 12V submersible water pump is responsible for pumping water from the main reservoir to the drinking plate when activated by the microcontroller. Its submersible design ensures efficient water transfer while maintaining a tidy appearance.

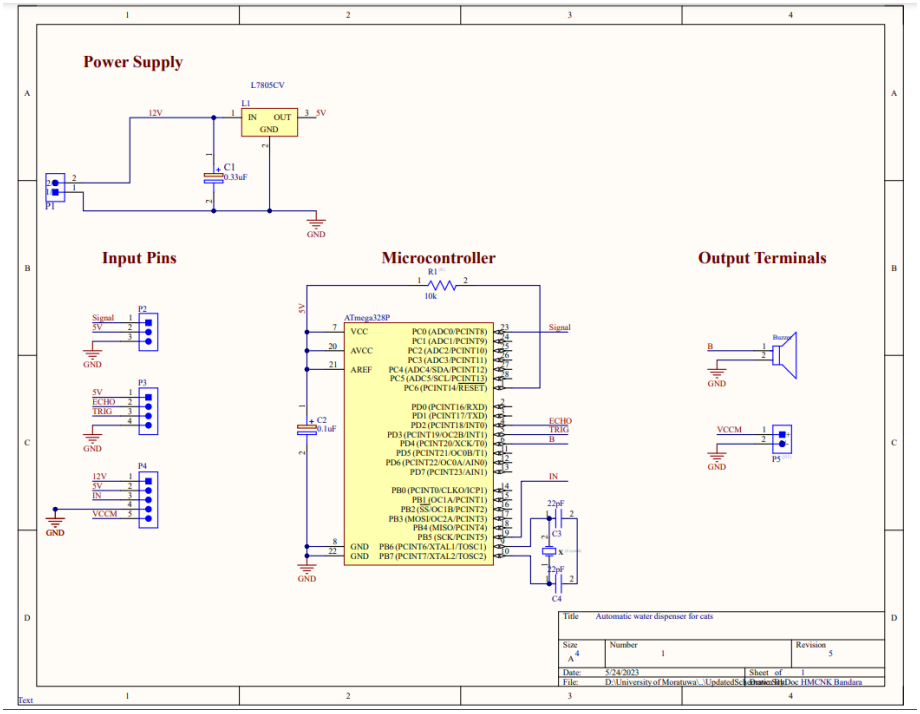
By integrating these selected components into the design and implementation of the Automatic Water Dispenser for Pets, the product is equipped with the necessary tools to detect pets' presence, manage water levels, and provide a continuous supply of clean water. The combination of the microcontroller, sensors, relay module, power adapter, and water pump create a comprehensive and efficient system that fulfills the product's intended functionalities and addresses the needs of both individual pet owners and institutional pet care providers.

4.2. Circuit design testing

The circuit was tested using proteus simulator and the simulation was successful.



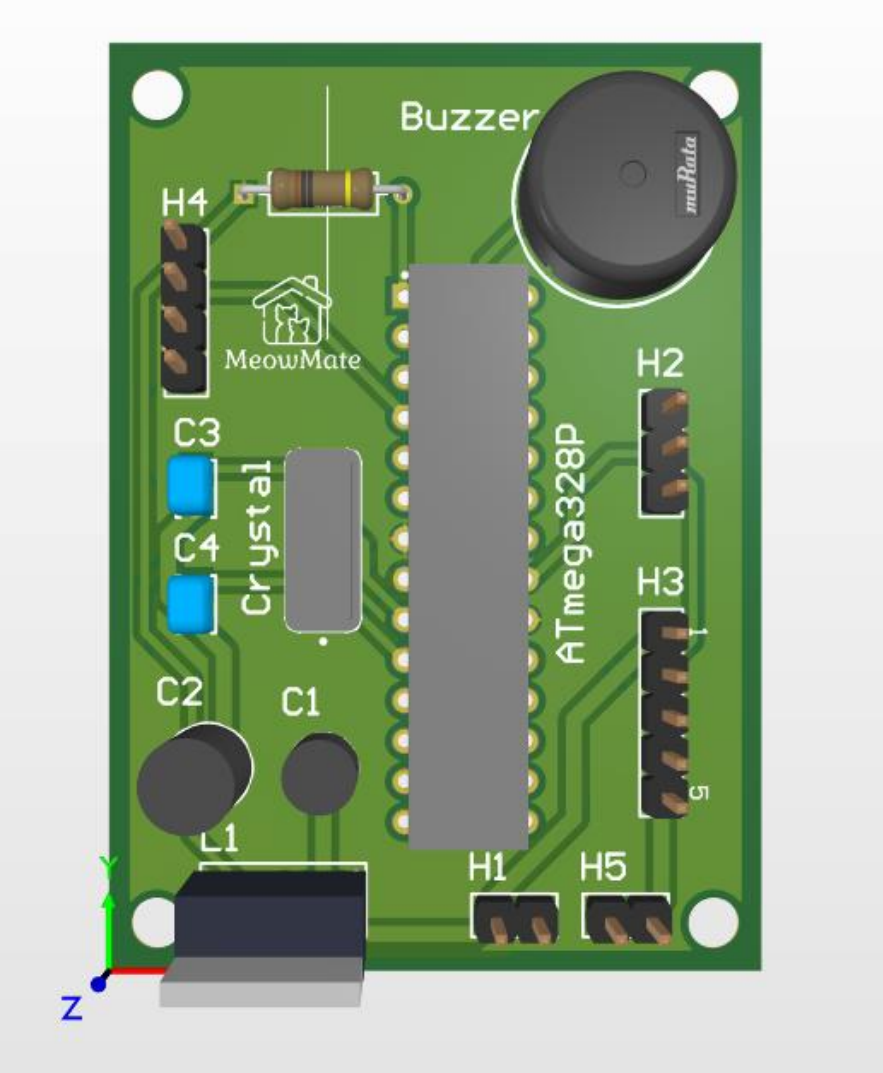
4.3. Schematics



4.4. Printed Circuit Board Design

Printed circuit board was designed with Altium Designer 23.3.1. It was a two-layer design. Manufacturing was done at JLCPCB in China. Therefore, online available JLCPCB design rules were imported to Altium Designer.

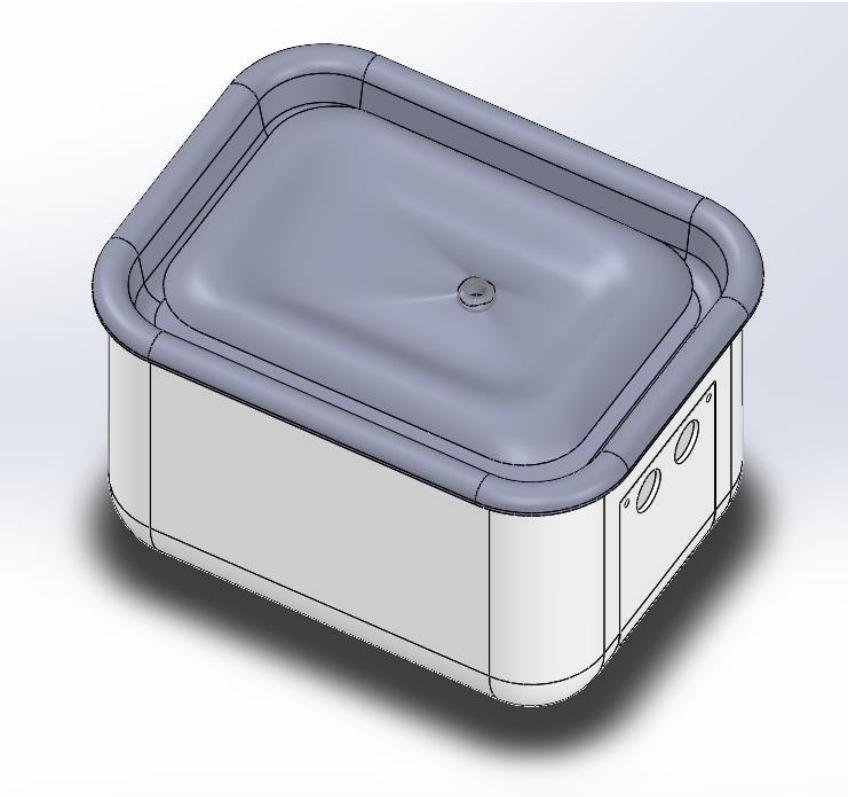
Refer Appendix I for schematic diagram and layout respectively.



4.5. Enclosure Design

Enclosure design was designed with SOLIDWORKS 2020.enclosure consists of plate, sink and container. Plastic is used in the enclosure. 3mmx 5mm screws were used to connect parts.

SOLIDWORKS Design



5. BOM

Description	Quantity
5V Relay Module	1
12V Submergible water pump	1
ATMega328P Microcontroller	1
HC-SR04 Ultrasonic Sensor	1
SEN18 Water level sensor	1
12V Power Adapter	1
0.1µF Capacitor	1
0.33µF Capacitor	1
22pF Capacitor	2
L7805 Voltage regulator	1
16MHz Crystal Oscillator	1
10kΩ resistor	1
Buzzer	1
JST Connectors (2port)	2
JST Connectors (3port)	1
JST Connectors (4port)	1
JST Connectors (5port)	1
Wires	1m
PCB (Manufactured by JLC PCB)	1
Enclosure	1

6. Software implementation

Calibration

```
#define sensorPin A0

int val = 0;

void setup()

{

  Serial.begin(9600);

}

void loop() {

  int level = readSensor();

  delay(1000);

}

  int readSensor() {

  val = analogRead(sensorPin);

  return val;

}
```

Dispenser

```
int Threshold = 650;

#define sensorPin A0

#define echoPin 2

#define trigPin 3

#define Control 13

int val = 0;

long duration;

int distance;

void setup()

{

  Serial.begin(9600);

  pinMode(trigPin, OUTPUT);

  pinMode(echoPin, INPUT);
```

```
 pinMode(Control, OUTPUT);
 digitalWrite(Control, LOW);
}
void loop()
{
 digitalWrite(trigPin, LOW);
 delayMicroseconds(2);
 digitalWrite(trigPin, HIGH);
 delayMicroseconds(10);
 digitalWrite(trigPin, LOW);
 duration = pulseIn(echoPin, HIGH);
 distance = duration * 0.034 / 2;
 int level = analogRead(A0);
if (distance > 30)
{
 digitalWrite(Control,LOW);
}
 else
  {
    if (level > Threshold)
   {
      digitalWrite(Control, LOW);
   }
  else
   {
   digitalWrite(Control, HIGH);
   }
  delay(100);
}
}
```

7. Future Developments

In the pursuit of future developments for the Automatic Water Dispenser for Pets, the following innovative approaches can be explored:

- **Smart Connectivity**: Incorporate Wi-Fi or Bluetooth connectivity to allow pet owners to remotely monitor and control the dispenser through a dedicated mobile app. This feature enables real-time alerts, water level monitoring, and convenient dispenser activation, even when the owners are away from home.

- **Pet Recognition and Personalization**: Implement advanced sensors and machine learning algorithms to recognize and differentiate between multiple pets. This technology would allow for personalized water dispensing settings based on each pet's preferences and needs, ensuring optimal hydration for every individual.

- **Enhanced Filtration System**: Upgrade the filtration system to include additional stages, such as activated carbon or UV purification, to further enhance water quality. This improvement would effectively remove a broader range of contaminants, ensuring the cleanest and safest drinking water for pets.

- **Advanced Water Level Monitoring**: Introduce an advanced water level monitoring system that provides historical data and usage patterns. This valuable information can be used to analyze pets' drinking habits, detect any irregularities, and optimize water usage for improved efficiency.

- **Variable Reservoir Capacities**: Offer a range of main reservoir capacities to cater to the diverse needs of pet owners, accommodating single-pet households as well as multi-pet environments. This flexibility ensures that the dispenser can be tailored to individual requirements.

- **Food Dispensing Integration**: Explore the possibility of integrating a food dispensing system alongside the water dispenser. This innovation would enable pet owners to automate feeding routines, enhancing convenience and promoting a balanced diet for their pets.

- **Medicine Dispensing Capability**: Add a system that allows for the precise addition of medicine to the water for individual pets. This feature would aid in administering medications to pets, particularly useful for those with specific health conditions or in need of regular supplements.

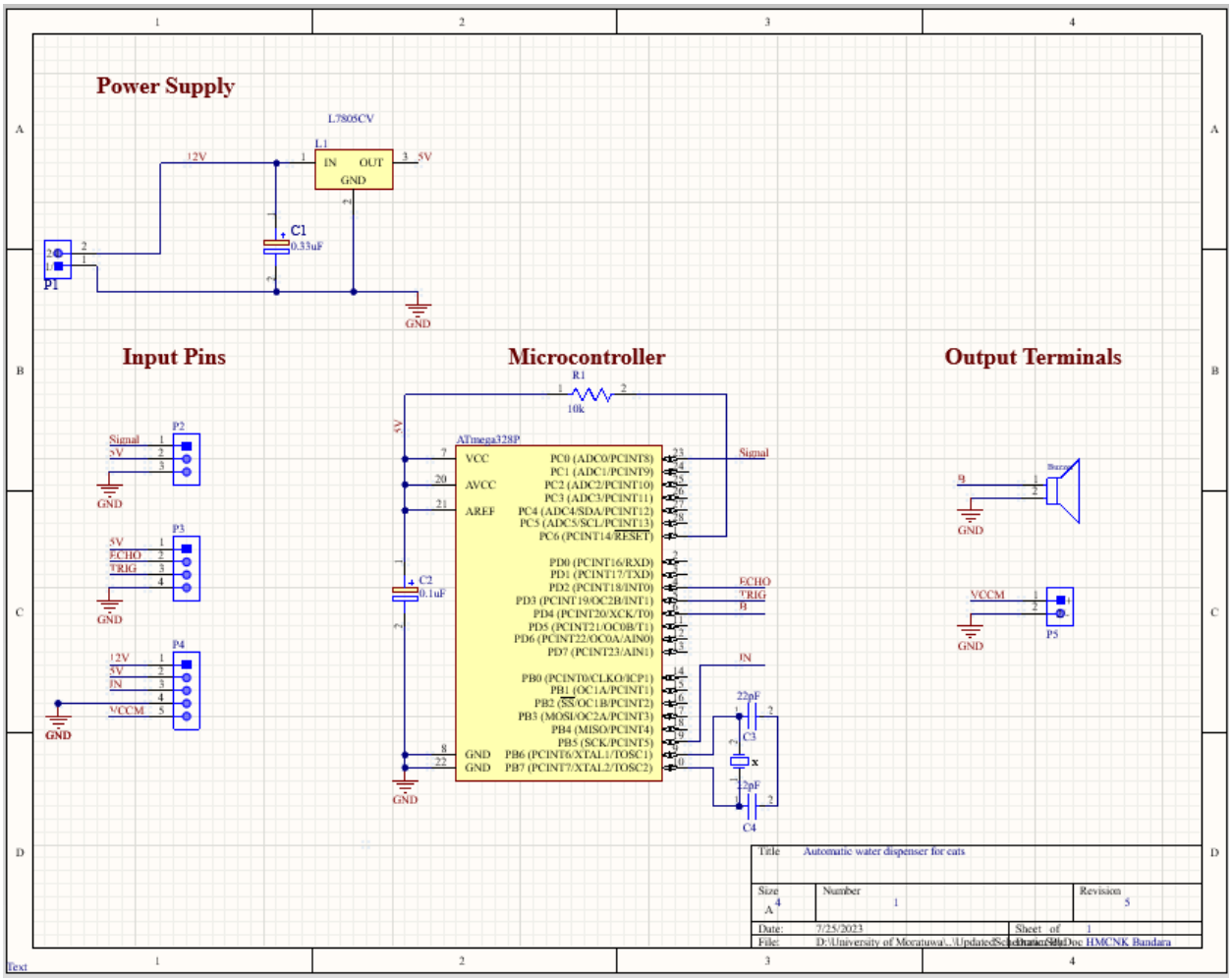
By incorporating these innovative approaches into the Automatic Water Dispenser for Pets, the product can truly revolutionize the way pet owners care for their beloved companions. With smart connectivity,

personalized pet care, advanced filtration, and additional functionalities like food and medicine dispensing, the dispenser becomes a comprehensive and intelligent solution for pet health and wellbeing.

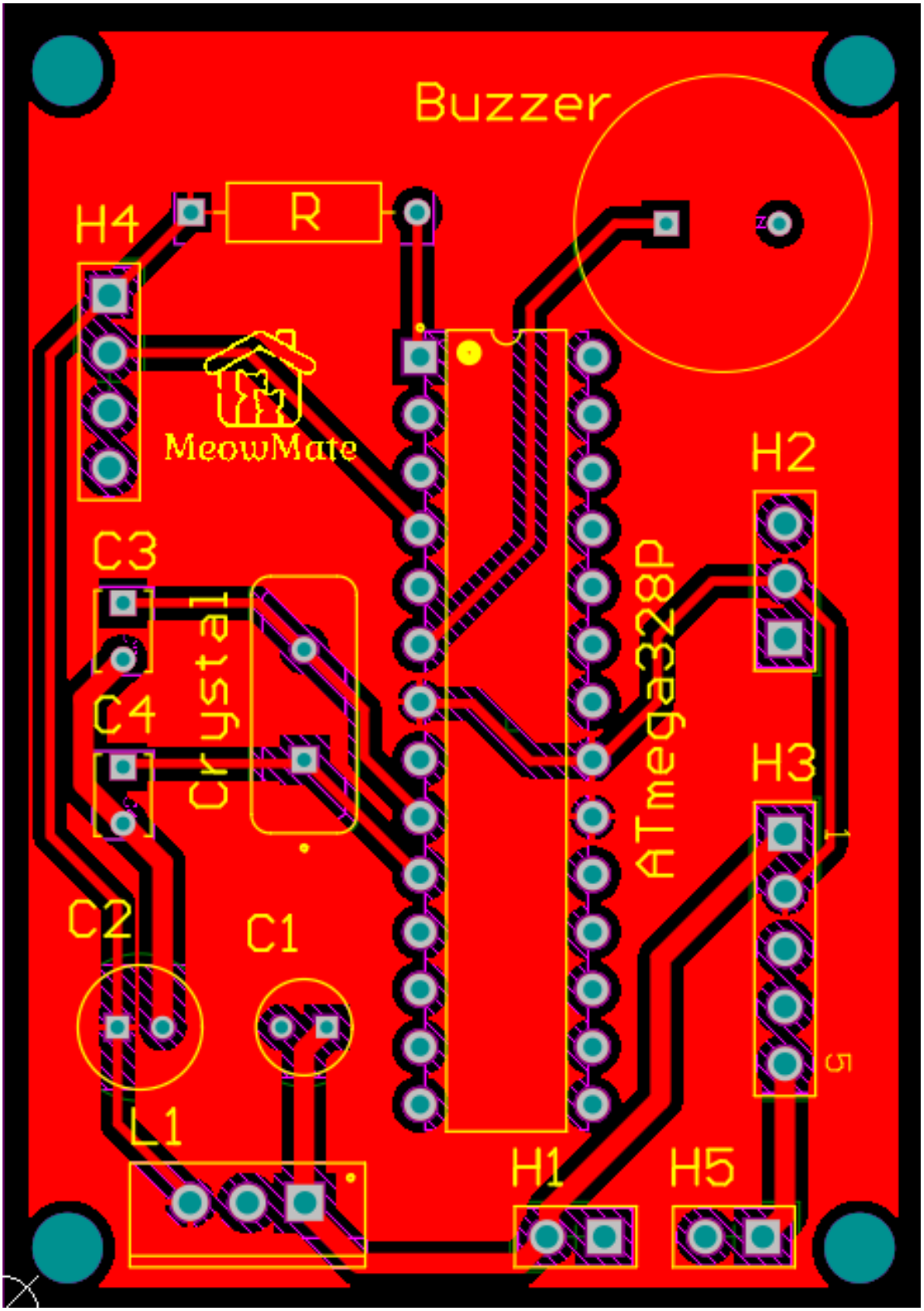
8. Appendix

Appendix I – PCB

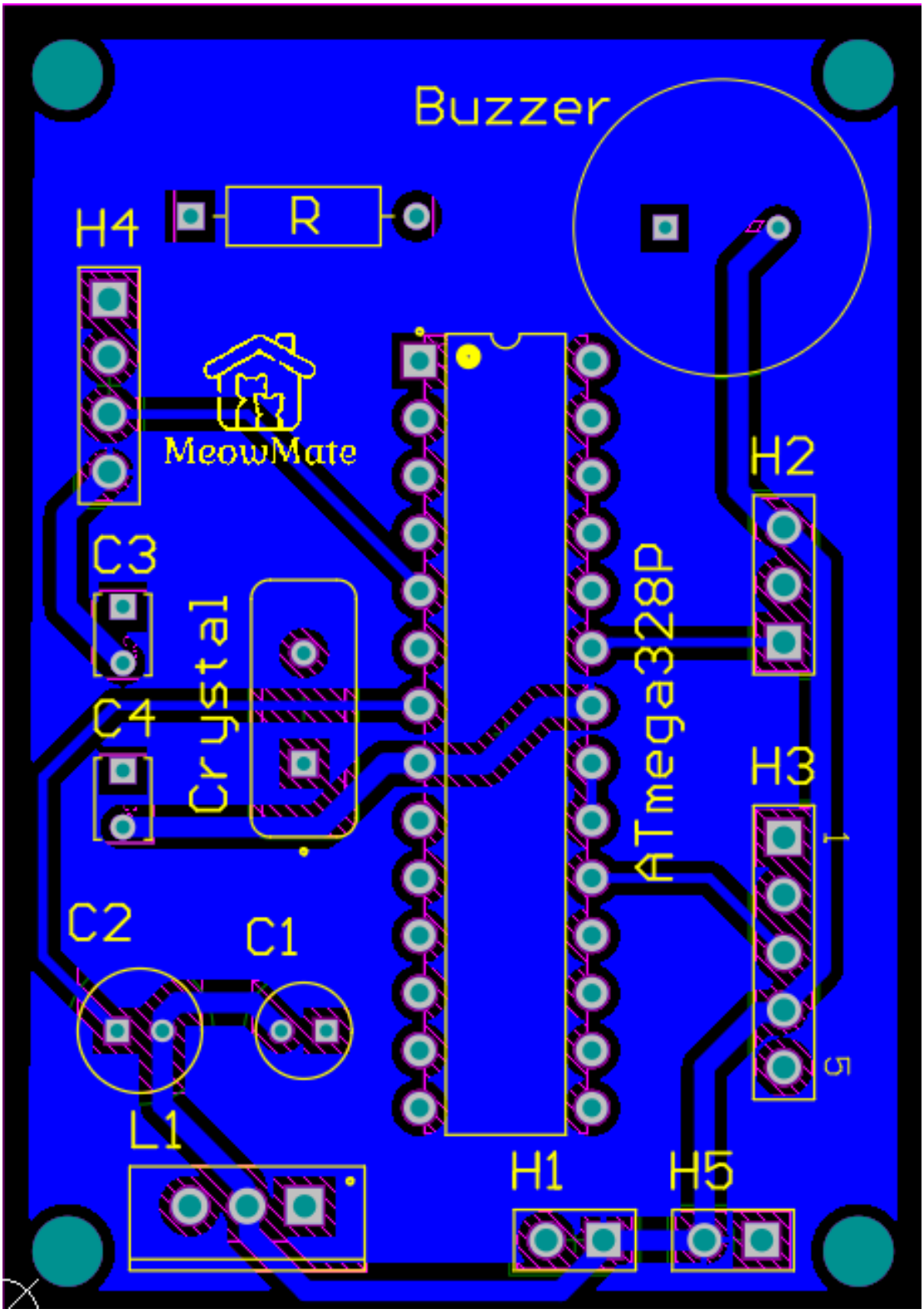
Schematic



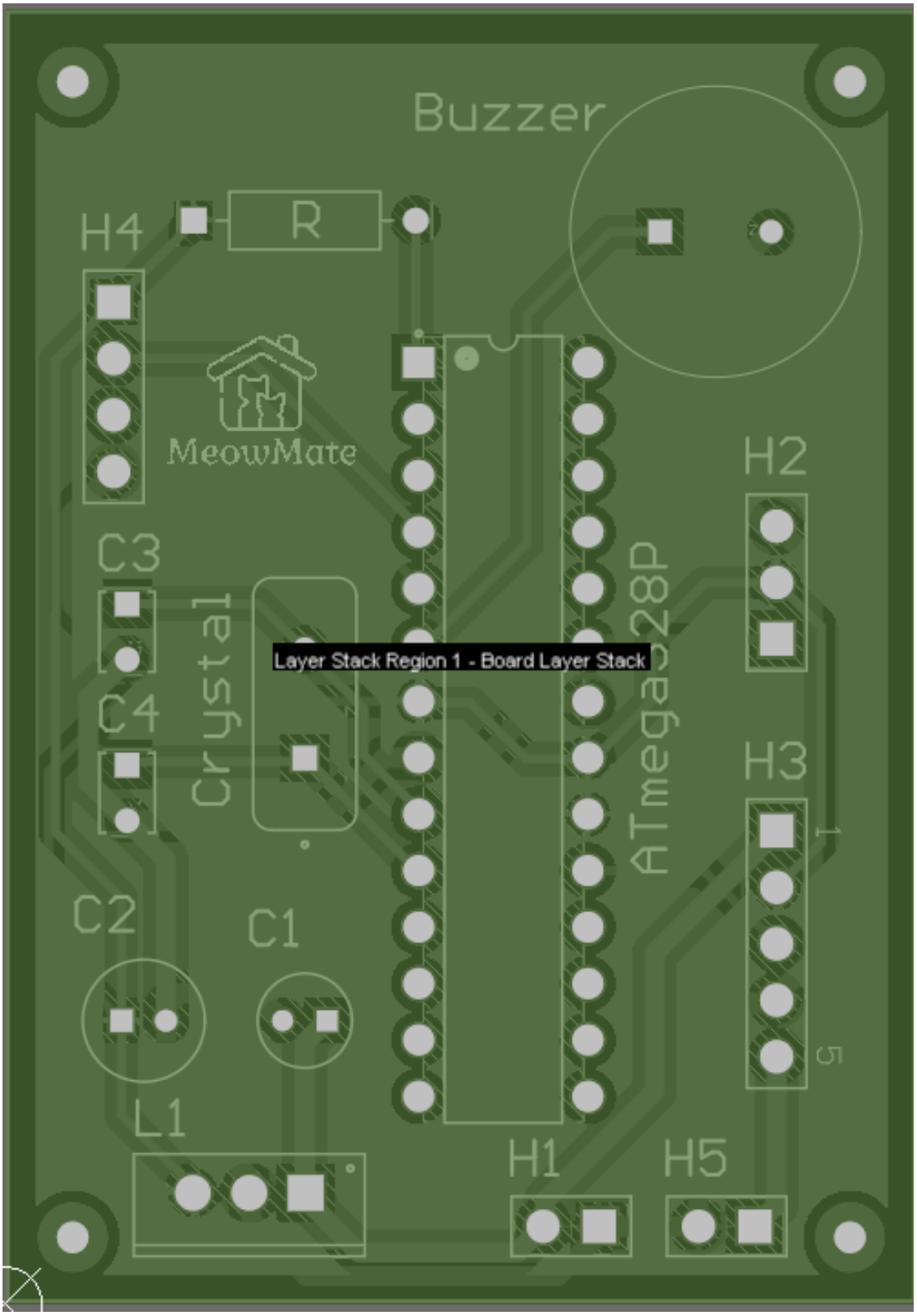
2D - Top Layer


Buzzer
H4
R
MeowMate
H2
C3
C4
Crystal
ATmega328P
H3
C2
C1
L1
H1
H5

2D - Bottom Layer

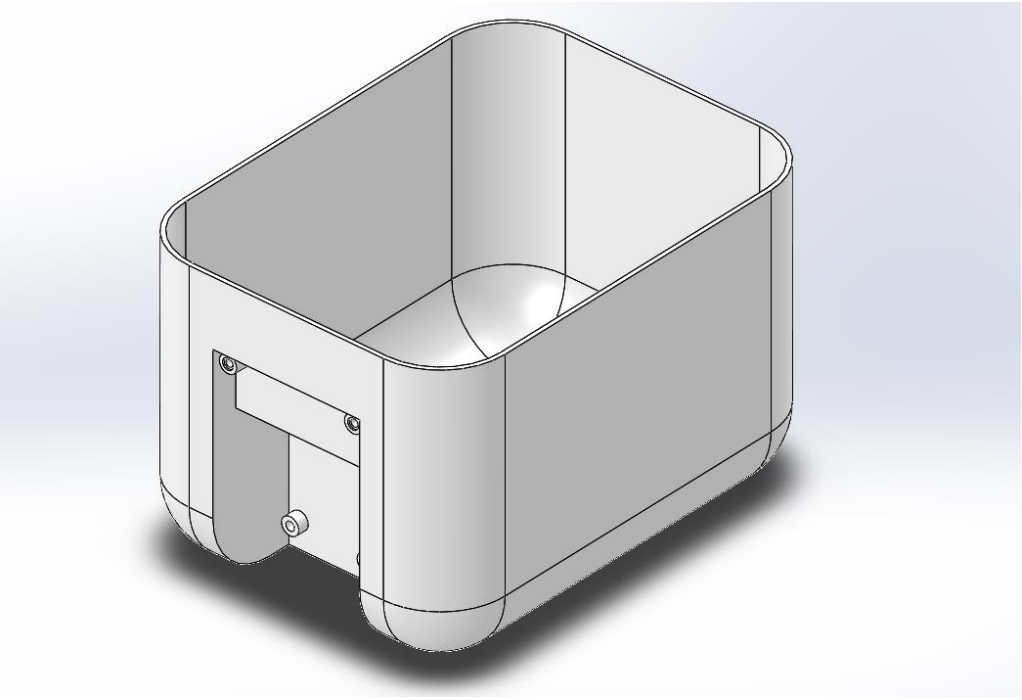


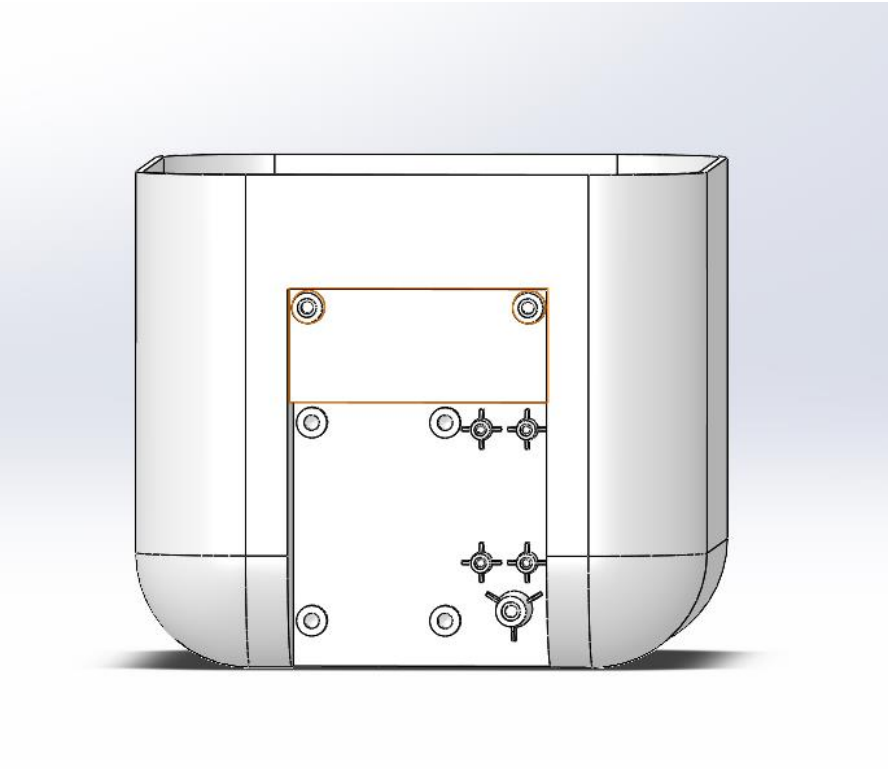
Board Planning mode



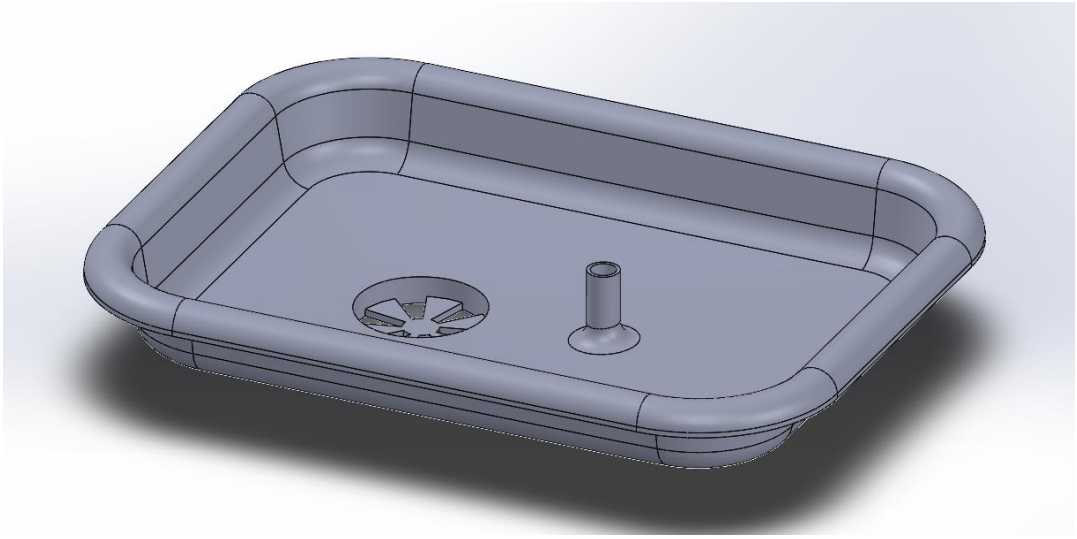
Appendix II – Enclosure Design

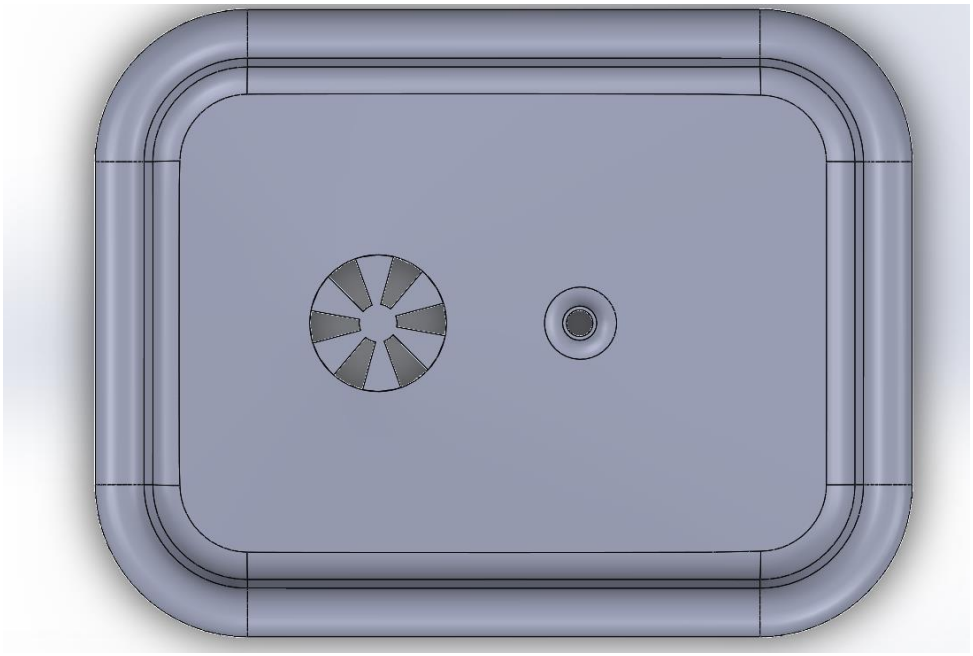
Main Reservoir

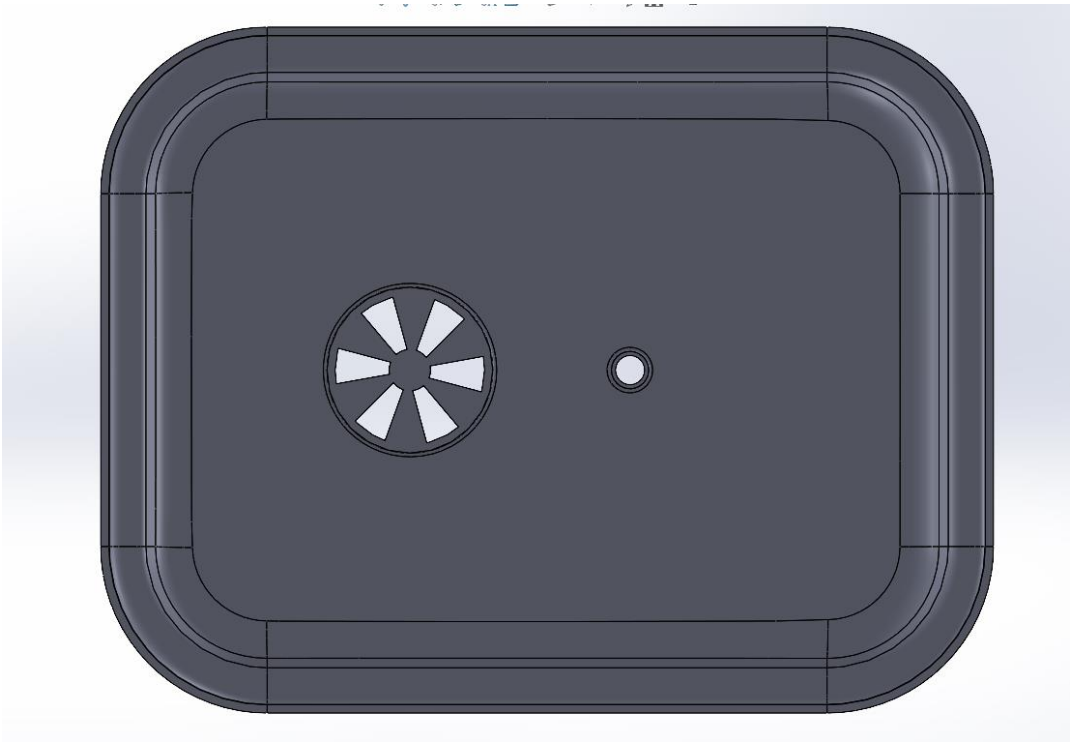




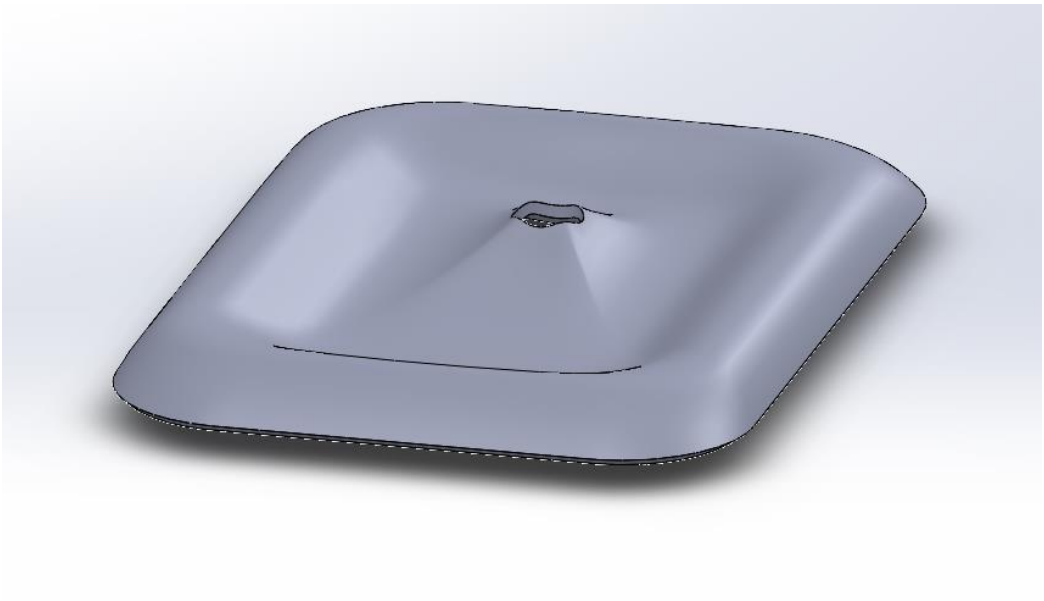
Sink







Top Plate



Appendix 3 – User Manual

User Manual – Automatic water dispenser for pets

Introduction

Thank you for choosing our Automatic Water Dispenser for Pets. This user manual aims to provide you with all the necessary information to ensure a seamless and safe experience while using our product. The dispenser is designed to provide a constant supply of clean water for your pets, even when you are away, promoting their wellbeing and health.

Product Overview

The Automatic Water Dispenser for Pets is an innovative device that automatically detects your pet's presence and dispenses water on demand. Equipped with an ultra-sonic sensor and water level sensor, the dispenser ensures efficient water usage and filtration for your pet's convenience. The smart design allows for water recycling, making it an energy-efficient and eco-friendly solution.

Key Features

- Ultra-sonic Sensor: Detects your pet's presence, activating the water dispensing mechanism when needed.
- Water Level Sensor: Monitors the water level in the main reservoir and alerts you when it's time to refill.
- Buzzer Alert System: Notifies you when the water level is low and requires refilling.
- Energy-efficient: The dispenser conserves water through intelligent recycling and minimizes electricity consumption.
- Filtration System: Ensures clean and safe water for your pets by removing impurities and contaminants.
- User-friendly Interface: Simple controls make it easy to set up and operate the dispenser.

Safety Precautions

- Use only the provided power adapter and specified accessories to avoid damage or hazards.
- Do not immerse the main unit in water to prevent electrical hazards.
- Regularly check the power cord for signs of damage and ensure its kept away from sharp objects or pet bites.

Assembling

1. Unbox the Automatic Water Dispenser for Pets and ensure all components are included.
2. Attach the water pump securely to the main container's designated compartment.
3. Place the filtration system in the filter compartment in the sink.
4. Connect the power adapter to the dispenser and the electrical outlet.
5. Wait for the buzzer sound to confirm proper setup.

Maintenance

- Regularly check and clean the water pump and filtration system to ensure optimal performance.
- Refill the main reservoir as needed, guided by the water level sensor and buzzer alerts.
- If the dispenser exhibits any unusual behavior or malfunctions, refer to the troubleshooting section of this manual or contact our customer support for assistance.

Troubleshooting

1. **Water Dispenser Not Activating**
    - Check if the power adapter is securely connected to the dispenser and the electrical outlet.
    - Ensure that the power switch is turned on.
    - Verify that the water level is sufficient for the dispenser to activate.
2. **No Water Flowing to the Drinking Plate**
    - Check if the water pump is securely connected to the dispenser and the power supply.
    - Inspect the water pump for any clogs or obstructions that may be blocking the water flow.
    - Ensure that the water level is above the minimum requirement for the pump to function properly.
3. **Buzzer Continuously Activated**
    - Check the water level in the main reservoir. Refill the reservoir if the water level is low.
    - Inspect the water level sensor for any debris or malfunctions that may be triggering the alert.
    - Ensure that the water level sensor is securely connected to the dispenser.
4. **Water Leakage from the Dispenser**
    - Check for any cracks or damage in the dispenser's exterior that may be causing the leakage.
    - Verify that all connections, especially those related to the water pump and filtration system, are tightly sealed.
    - Ensure that the dispenser is placed on a level surface to prevent water from spilling.
5. **Unusual Noises During Operation**
    - Check for any loose components or parts within the dispenser.
    - Inspect the water pump for any foreign objects that may be causing the noise.
    - If the noise persists, contact our customer support for further assistance.
6. **Inaccurate Sensor Detection**
    - Clean the sensors and PCB carefully to remove any dirt or debris that might be affecting their functionality.
    - Ensure that there are no obstacles or obstructions in the sensor's detection area.
    - If the issue persists, consider recalibrating the sensors or contact our customer support for guidance.
7. **Dispenser Not Powering On**
    - Check the power adapter and electrical outlet for any issues. Try using a different outlet.
    - If the power adapter appears damaged or faulty, replace it with a compatible one.
    - Inspect the power switch and make sure it is functioning correctly.

Safety Information and Warnings

- Do not attempt to disassemble or repair the dispenser yourself. Contact authorized service personnel for any repairs.
- Avoid exposing the dispenser to extreme temperatures or direct sunlight.
- Always unplug the dispenser from the power outlet before cleaning or performing any maintenance.
- If the dispenser or power cord is damaged, discontinue use immediately and seek professional assistance.

We hope this user manual helps you make the most of your Automatic Water Dispenser for Pets. For any further inquiries or assistance, feel free to contact our customer support team.

Note: The contents of this user manual are subject to change without notice due to ongoing product improvements. Please refer to the latest version available on our website for the most up-to-date information.

Appendix 4 - Maintenance Manual

Maintenance Manual – Automatic water dispenser for pets

Introduction

Welcome to the Maintenance Manual for the Automatic Water Dispenser for Pets. Regular maintenance is essential to ensure the longevity and optimal performance of your product. This manual provides step-by-step instructions for cleaning, troubleshooting, and handling of the dispenser, ensuring a safe and seamless experience for you and your pets.

Maintenance Schedule

Regular inspections and cleaning are vital to keep the Automatic Water Dispenser functioning efficiently. Here's a suggested maintenance schedule:

1. Daily: Check water level and refill as needed. Inspect the product's exterior for any spills or debris.
2. Weekly: Clean the product's exterior, sensors, and PCB to prevent dust buildup and maintain hygiene.
3. Monthly: Perform a thorough inspection of the water pump, filtration system, and all connections for any signs of wear or damage.

Cleaning Procedures

1. Product Exterior:
    - Wipe the exterior with a soft, damp cloth to remove dust and dirt.
    - Use a mild detergent if needed but avoid harsh chemicals that may damage the surface.
2. Product Interior and Filtration System:
    - Turn off the power and unplug the dispenser before cleaning the interior.
    - Carefully remove the filtration system and wash it under running water.
    - Allow all components to air-dry completely before reassembling.
3. Sensors and PCB:
    - Gently wipe the sensors and PCB with a dry, lint-free cloth to remove any dirt or moisture.
    - Avoid using water or cleaning agents on the sensors to prevent damage.

Troubleshooting

If the Automatic Water Dispenser exhibits any issues, refer to the Troubleshooting section in the User Manual. Common issues and potential solutions will be outlined there. If problems persist, please contact our customer support for further assistance.

Replacement Parts

In case of damaged or malfunctioning components, contact our authorized service centers to purchase genuine replacement parts. Only use original parts to maintain the product's integrity and performance.

Warranty Information

Please refer to the Warranty Information provided in the product packaging or on our website for details regarding the product's warranty coverage and terms.

Safety Precautions

- Always unplug the dispenser before performing any maintenance or cleaning.
- Avoid exposing the dispenser to water or harsh cleaning agents to prevent electrical hazards.
- Do not disassemble the product beyond what is specified in this maintenance manual.

Storage and Transportation

- Store the Automatic Water Dispenser in a cool, dry place away from direct sunlight and extreme temperatures.
- When transporting the dispenser, secure it properly to prevent damage or shifting during transit.

Regular maintenance and proper care will ensure the continued functionality and longevity of your Automatic Water Dispenser for Pets. If you have any questions or concerns, please do not hesitate to reach out to our customer support team for assistance.

Appendix 5 – Production Manual

Production Manual – Automatic water dispenser for pets

Introduction

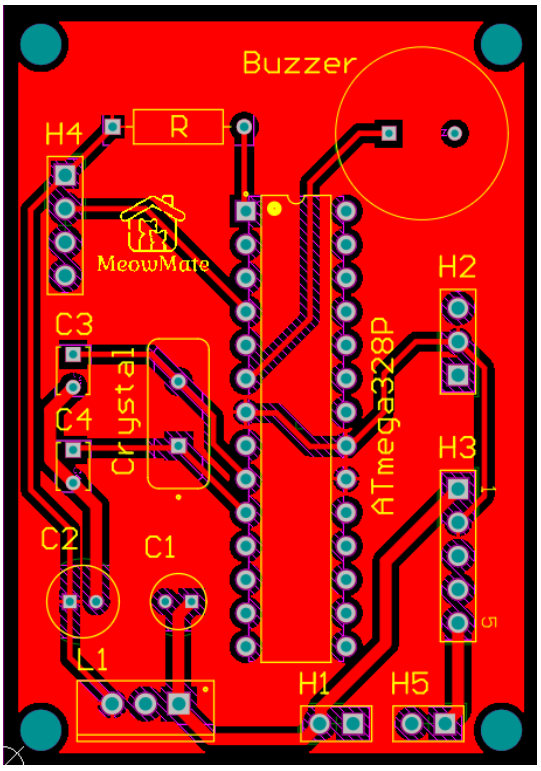
Welcome to the Automatic Water Dispenser for Pets Production Manual. This comprehensive guide provides a detailed outline of the step-by-step procedures and best practices for manufacturing the Automatic Water Dispenser for Pets. It is crucial to carefully follow these instructions to ensure consistent and efficient production, resulting in high-quality products. Before commencing any manufacturing activities, please thoroughly familiarize yourself with the entire production process.

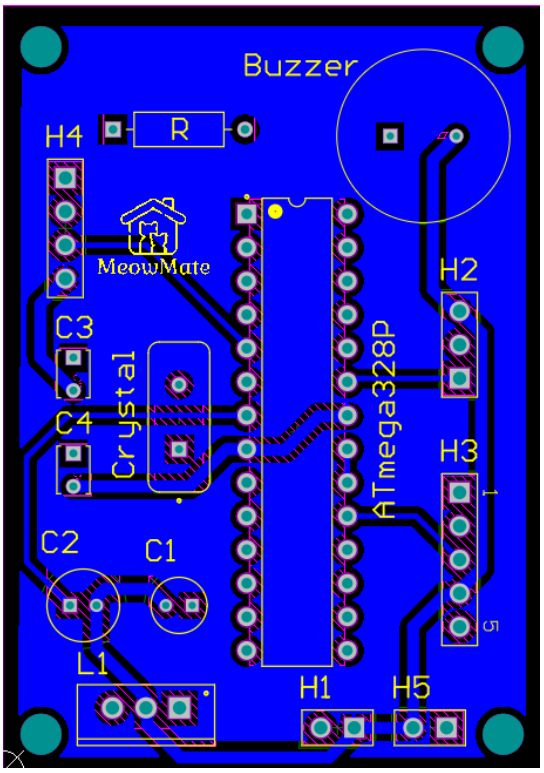
Bill of Materials

Description	Quantity
5V Relay Module	1
12V Submergible water pump	1
ATMega328P Microcontroller	1
HC-SR04 Ultrasonic Sensor	1
SEN18 Water level sensor	1
12V Power Adapter	1
0.1µF Capacitor	1
0.33µF Capacitor	1
22pF Capacitor	2
L7805 Voltage regulator	1
16MHz Crystal Oscillator	1
10kΩ resistor	1
Buzzer	1
JST Connectors (2port)	2
JST Connectors (3port)	1
JST Connectors (4port)	1
JST Connectors (5port)	1
Wires	1m
PCB (Manufactured by JLC PCB)	1
Enclosure	1

Production Process

PCB Fabrication





PCB Design and Layout

Create the PCB design using computer-aided design (CAD) software, ensuring the layout accommodates all the components and connections.

Consider proper grounding and routing to minimize interference and ensure signal integrity.

If you are using **Altium Designer** to design the schematic and the PCB following components can be used.

Description	Footprint Name	Designator
ATMega328P Microcontroller *8-bit AVR Microcontroller, 32KB Flash, 1KB EEPROM, 2KB SRAM, 28-pin PDIP, Industrial Grade (-40°C to 85°C)*	28P3	ATMega328P
0.33µF Capacitor	CAPPRD200W45D425H650	C1
0.1µF Capacitor	CAPPRD200W50D550H1200	C2
22pF Capacitor *Cap Ceramic 22pF 100V C0G ±5% Radial 2.5mm +125°C Bulk*	FP-RCE0DB-MFG	C3, C4
L7805 Voltage regulator *Positive Voltage Regulator, 5V, 3-Pin TO-220*	TO220	L1

16MHz Crystal Oscillator *Resistance Weld Thru-Hole Crystal, 16 MHz, -20 to 70 degC, 2-Pin THD, RoHS, Bulk*	FOX-FOXSLF160-20	Crystal
10kΩ resistor *RES 10 OHM 1/4W 5% AXIAL*	FP-CFR-25-MFG	R
Buzzer *AUDIO PIEZO TRANSDUCER 30V TH*	FP-PKM13EPYH4000-A0-MFG	Buzzer
2 Pin Header for the power supply and water pump *Pin Header, pitch 2.54 mm, THT, Vertical, single row, 2p*	61300211121	H1, H5
3 Pin Header for the water level sensor *Pin Header, pitch 2.54 mm, THT, Vertical, single row, 3p*	61300211121	H2
5 Pin Header for the relay module *Pin Header, pitch 2.54 mm, THT, Vertical, single row, 5p*	61300211121	H3
4 Pin Header for the ultra sonic sensor *Pin Header, pitch 2.54 mm, THT, Vertical, single row, 4p*	61300211121	H4

Prototype Testing

- Create a prototype of the PCB to validate the design and ensure its functionality.
- Thoroughly test the prototype for any issues or shortcomings.

Mass Production

- Once the prototype is successfully tested, proceed with mass production of the PCB.
- Collaborate with a reputable PCB manufacturing facility to maintain consistent quality.

Component Assembly

Component Procurement

- Source the necessary electronic components from authorized suppliers, adhering to quality standards and specifications.
- Ensure the availability of the Atmega328P microcontroller, water sensor, and ultrasonic sensor.

Soldering

- Assemble the electronic components on the PCB using precise soldering techniques, either automated or manual.
- Pay close attention to soldering to prevent loose connections and faulty joints.

Firmware Integration

Atmega328P Programming

- Develop and test the firmware code for the Atmega328P microcontroller, incorporating the water sensor and ultrasonic sensor functionalities.

Enclosure Selection

- Select a suitable enclosure that accommodates all components and provides adequate protection for the Automatic Water Dispenser.
- Ensure the enclosure meets necessary safety standards and environmental requirements.

Labeling and Branding

- Apply product labels and branding on the exterior of the enclosure as per the organization's guidelines.

Quality Control

Functional Testing

- Conduct thorough functional testing of each assembled Automatic Water Dispenser to verify accurate water level sensing and ultrasonic sensor detection.

Calibration

- Calibrate the water sensor and ultrasonic sensor to ensure precise measurements and reliable operation.

Buzzer Functionality

- Test the buzzer function to ensure it activates appropriately when the water level is low or when pets are detected.

Packaging and Shipping

Product Packaging

- Package each Automatic Water Dispenser securely to safeguard against damage during transportation and storage.
- Include user manuals and relevant documentation with each unit.

Shipping and Logistics

- Partner with reliable shipping and logistics companies to ensure prompt and safe delivery to customers.

The production of the Automatic Water Dispenser for Pets demands careful attention to detail and adherence to the outlined procedures. By following this Production Manual, you can ensure consistent quality, functionality, and reliability in the final product. Implementing proper quality control measures will lead to high customer satisfaction and a successful market launch of the Automatic Water Dispenser for Pets.

8. References

1. HC-SR04: Datasheet, Specs, and More | ElectroSchematics
2. 5V Single-Channel Relay Module - Pin Diagram, Specifications, Applications, Working (components101.com)
3. https://www.alldatasheet.com/view.jsp?Searchword=ATMEGA328P&sField=4
4. https://curtocircuito.com.br/datasheet/sensor/nivel_de_agua_analogico.pdf