DEVELOPMENT OF AN AUTOMATED DOG NOURISHMENT DISPENSER USING MICROCONTROLLER

DHURGA A/P S PARAMASIVAM

B082110521

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AN AUTOMATED DOG NOURISHMENT DISPENSER USING MICROCONTROLLER

DHURGA A/P S PARAMASIVAM

This report is submitted in partial fulfilment of the requirements for the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours

Faculty of Electronic and Computer Engineering and Technology
Universiti Teknikal Malaysia Melaka

2024/2025

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI DAN KEJURUTERAAN ELEKTRONIK DAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : DEVELOPMENT OF AN AUTOMATED DOG NOURISHMENT DISPENSER USING MICROCONTROLLER

Sesi Pengajian : 2024/2025

Saya DHURGA A/P S PARAMASIVAM mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

☐ **SULIT*** (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

☐ **TERHAD*** (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☐ **TIDAK TERHAD**

Disahkan oleh:

_____ .....

Alamat Tetap:

Tarikh :05/02/2025 Tarikh : 05/02/2025

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project report entitled “DEVELOPMENT OF AN AUTOMATED DOG NOURISHMENT DISPENSER USING MICROCONTROLLER” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Student Name : DHURGA A/P S PARAMASIVAM

Date : 20/01/2025

.....

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours

Signature : .....

Supervisor Name : .....

Date : .....

DEDICATION

First and foremost, I would like to thank to the God for make me stronger enough to handle a thesis as well with full of determination and courage. Secondly, I'm also responsible to thank my parents for helped me to develop some ideas regarding the project in initial stage and also support me morally throughout the finding process of this thesis as well. Next, I would like to thank my institution Universiti Teknikal Malaysia Melaka (UTeM) for educated me with all the deep fundamentals which help me to drive the research with full charisma. Apart from this I also want to appreciate my fellow friends who have been the supporting pillar and discussing person and also the creative adviser who contributed indirectly for completion of this thesis in great manner.

ABSTRACT

This project aims to help dog owners who face difficulties in maintaining a regular eating and drinking schedule for their pets by developing an automatic dog food dispenser system using microcontroller technology. With the Blynk smartphone app, users can set customized eating and drinking times. The dog will eat the correct amount and benefit from improved health because the weight sensor in the dispenser precisely gauges how much food is given at each feeding session. Additionally sensors that detect low food or water levels notify pet owners through the Blynk app so that food is always available. The system is successfully implemented providing a useful means of managing pets nutritional needs according to the main findings. The systems ability to dispense precise portions track food and water levels and alert users when refills are required has been demonstrated through testing and validation. By making it easier to maintain a regular feeding and drinking schedule this project enhances the quality of life for pet owners and the wellbeing of their dogs. Future research can further enhance pet care by utilizing cutting-edge technology and adding more features.

ABSTRAK

Matlamat projek ini adalah untuk membantu pemilik anjing yang berjuang untuk menjaga haiwan peliharaan mereka pada jadual pemakanan dan penyiraman biasa. Sistem dispenser khasiat anjing automatik telah dicipta menggunakan teknologi mikropengawal dengan matlamat untuk memudahkan penjagaan haiwan peliharaan. Sistem ini termasuk aplikasi telefon pintar tambahan yang dipanggil Blynk yang membolehkan pengguna membuat jadual pemakanan dan penyiraman yang diperibadikan berdasarkan keperluan haiwan kesayangan mereka. Jumlah makanan yang diagihkan semasa setiap sesi penyusuan diukur dengan tepat dengan memasukkan sensor berat ke dalam mekanisme dispenser sebagai sebahagian daripada teknik penyelidikan. Dengan melakukan ini, ia telah memastikan bahawa anjing makan jumlah yang betul, meningkatkan kesihatan dan kesejahteraan mereka. Tambahan pula, sistem itu dipasang dengan penderia yang boleh mengenal pasti paras makanan atau air yang rendah. Penderia ini kemudiannya akan memberitahu pemilik haiwan peliharaan dengan segera melalui aplikasi Blynk, menjamin bahawa makanan akan sentiasa tersedia. Keputusan utama kajian menunjukkan bahawa sistem dispenser automatik telah berjaya dilaksanakan, menawarkan pemilik haiwan peliharaan cara yang praktikal dan berkesan untuk mengawasi keperluan pemakanan haiwan kesayangan mereka. Sistem ini terbukti cekap memantau paras makanan dan air, mengeluarkan bahagian yang tepat, dan memberi amaran kepada pengguna apabila pengisian semula diperlukan melalui ujian dan pengesahan yang meluas. Ringkasnya, dengan menyediakan kaedah mudah untuk mengekalkan jadual pemakanan dan penyiraman biasa, projek ini meningkatkan standard penjagaan haiwan peliharaan. Dispenser makanan anjing automatik bukan sahaja menjadikan kehidupan pemilik haiwan peliharaan lebih mudah, tetapi ia juga membantu memastikan kesihatan dan kebahagiaan rakan berkaki empat mereka. Untuk menambah baik prosedur penjagaan haiwan kesayangan, projek penyelidikan masa depan mungkin melihat ke dalam menambah lebih banyak fungsi pada sistem dan menyepadukannya dengan teknologi canggih.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank and praise God the Almighty, my Creator, my Sustainer, for everything I received since the beginning of my life. I would like to extend my appreciation to the Universiti Teknikal Malaysia Melaka (UTeM) for providing the research platform. Thank you also to the Malaysian Ministry of Higher Education (MOHE) for the financial assistance.

My utmost appreciation goes to my main supervisor, EN RADI HUSIN BIN RAMLEE, Universiti Teknikal Malaysia Melaka (UTeM) for all his support, advice and inspiration. His constant patience for guiding and providing priceless insights will forever be remembered.

I would also like to thank my beloved parents for their endless support, love and prayers. Finally, thank you to all the individual(s) who had provided me the assistance, support and inspiration to embark on my study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

1.1 Background

Recently there has been a shift in the way pet owners interact with and care for their animal companions. Pet owners are looking for innovative ways to address challenges related to pet care particularly those related to sticking to regular feeding and watering schedules as the number of families incorporating pets into their homes rises. Historically pet owners have relied on manual methods to ensure that their animals receive adequate food throughout the day. However these methods usually prove to be unworkable and unfeasible especially for those with busy schedules or multiple dogs. There is a growing need for automated systems that can speed up pet care procedures without sacrificing the well-being and health of a valued furry companion. Due to advances in technology and automation, the idea of an automatic dog food dispenser system came about as a way to help dog owners who find it difficult to keep their pets on a regular feeding and watering schedule. This project is revolutionizing pet feeding Tracy by completely eliminating the role of the pet owner and using microcontroller technology. Other added features such as splitting feeding and watering schedules by day for dogs provides the user with unmatched convenience and renewed flexibility through the Blynk app making it even more appealing to use. They do not over-feed or under-feed Pets by the use of weight sensors and precise measurements that guarantees the right amount of feed required by the Pet. Similar to managing stocks in a butchery, for instance, sensors are also able to detect little food or even water in bowls, and alert the owners through the Blynk application. This proactive system reassures the pet owners that their pet will always be well fed and nourished even with changes in their daily schedule. The project enhances pet care through organizing operations, as well as enhancing pet quality of life through the use of microcontrollers featuring an accurate measure technology and the Blynk app. The attributes that can be attributed to this automated system include the following; Since it's an automated system, it means that the pet owner and his/her fur-ther-half do not necessarily have to handle the issue of the animal's nutritional requirements all by themselves. It also remains open to future enhancement where by relying on upward technology advancements in pet care procedures the efficiency of the program can be enhanced.

1.2 Enhancing Pet Care through Automated Dog Nourishment Dispenser Utilizing Microcontroller Technology

Several domestic and global beneficiaries of automatic dog food dispensers have been identified ranging from accessibility of animal welfare innovations, human health and welfare, to environmental concerns. This is the main goal of this initiative because pets deserve proper nutrition and feeding, and should not be left to starve due to their owners' demanding schedules. As it applies user-friendly solutions for different types of pet owners, it also carries progressive social messages like equality and inclusion into the online created world. Besides, in accordance with the goal of supporting sustainable environment this system contributes to the effort of minimizing food wastage as well as minimizing the effects on the environment. Moreover, the project has amended the lives of the pet owners since they are relieved of stress and most often, the rush of having to attend to pets. By supporting ethical pet ownership it improves communication among pet owners and fosters social interaction and community involvement, it creates a supportive community.

While today's different working schedules and unavailability of time for pet care chores including feeding and watering et cetera make it almost impossible to establish fixed feeding regimens for the pets to be fed on. They also experience diseases attributed to this unstructured lifestyle, and one of them is irregular feeding times. Lack of time is another reason many pet owners have as an excuse, due to daily activities they have to engage themselves in, they end up neglecting the times they have to feed their animals on time. Current ethical concerns and pet owner problems reveal the lack of a way to assess the necessary food intake of pets that might cause health issues like obesity or undernutrition.

1.3 Problem Statement

The irregular feeding issue is as a result of tight schedules on the part of the pet owners, inability to monitor their own feeding schedules and also other minor activities much as taking a drink that could come in between seeing to the feeding of their pets. Dogs living a modern life apartment life often interfere with their feeding schedule and health issues often arise since feeds and water are not provided on time as scheduled. Owners are also inconvenienced because, like any other person, they cannot be with their pets all the time to satisfy their needs in the shortest time. There are health issues which include obesity or even malnutrition arising mainly when the pet owner cannot meet the animal's feeding needs. This is especially the case since many of them cannot keep track of the amount of food they eat in any other way.

1.4 Project Objective

a) Use Precision Measurements for Precise Portion Control: Adding extra functions of weight sensors and other precise manipulating measurement tools into the sprinkler mechanism is another goal. This makes it possible to precisely control the portions given to dogs during feeding sessions ensuring they get the right amount of food and water to maintain their health and well-being and avoid obesity .

b) Designing and Developing an Automatic Dog Food and Water : The main objective of this project is to create a reliable and user-friendly automatic dog food sprinkler system using microcontroller technology. The system will automatically arrange for pets to be fed and watered ensuring they eat on schedule.

c) Notify Pet Owners in Real Time: This project was undertaken with a view of ensuring that pet owners are instantly informed on the status of their pets via a smartphone application. This function allows sprinkler system owners to check water and food levels remotely. Pet owners can monitor their pet's meal intake and receive notifications when refills are needed knowing that food is always available for their pet even when they are not at home..

1.5 Scope of Project

a) Design and development of automatic dog food sprinkler system with emphasis on hardware elements such as sprinkler mechanism, microcontroller integration and precision measurement technology.

b) Inserting a weight sensor in the sprinkler mechanism to guarantee accurate portion control during feeding sessions, adapting to different pet sizes and feeding needs.

c) Using the scheduling, monitoring and notification features built into the automatic sprinkler system by integrating it with Blynk's IoT platform.

d) Investigate and verify system hardware components including accuracy and reliability of parts under various operating conditions.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

These days, pet owners can easily control feeding schedules and make sure their pets are getting the proper amount of food thanks to automated feeding systems. By using software sensors and microcontrollers these devices automate feeding. The development of automated dog food dispensers through the use of microcontrollers is a noteworthy breakthrough that will improve pet cares precision and convenience[1]. In this review well look at how automated feeding systems work their benefits and the latest developments. By looking at the prior research we can gain knowledge about the technologies and architecture of these systems. This will help our automated dog food dispenser system to be designed and built more effectively.

2.2 Understanding

There have been references made in the literature about automated pet feeding devices. Among these are worries about food waste and the effects traditional feeding methods have on the environment pet obesity and the health risks it poses because of erratic portion control irregular feeding schedules that negatively impact pets wellbeing restricted access to pet care during busy schedules or in urban areas and questions about how advanced technologies like the Internet of Things can be used and accessed by a diverse range of pet owners. These issues must be resolved before effective microcontroller-based automated dog food dispensers can be developed and implemented. The one we currently have is made with an emphasis on accuracy in amount management schedule consistency sustainability and user-friendly interfaces. Improving dog health and owner convenience is our main objective along with encouraging moral and approachable pet care techniques.

2.3 Overview of Automated Feeding Systems

Many industries including agriculture and pet care are very interested in automated feeding systems. These systems offer precise feeding schedules portion control and real-time monitoring. Research like that done by Wardal et al (2021) [2] can help us understand pet feeding habits and the importance of good nutrition for dogs. Which may be useful in the creation of an Automated Dog Food Dispenser. Among others study highlights the potential health advantages of once-daily feeding in companion dogs underscoring the significance of feeding frequency in pet care.

Moreover studies such as this one show how wearable sensors and intelligent control systems can be combined to monitor and manage pet feeding habits. These technologies can enhance automated dispenser performance and boost system efficiency by providing real-time data on dogs behavior and emotional patterns. Furthermore observations from Wardal et al.(2021)[2] The economic and energy-related components of automated feeding systems in agricultural settings .It is possible to ensure the sustainability and affordability of the automated dog nourishment dispenser by guiding its design and implementation with a knowledge of the financial and technological implications of such systems.

To summarize a comprehensive comprehension of automated feeding systems can be achieved through the integration of research findings regarding pet feeding practices the health implications of frequent feeding technological advancements in monitoring systems and the energy requirements of automated feeding systems. This data will be essential to the development of an automated microcontroller-based dog food dispenser that is both successful and economical.

2.4 Role of IoT in Pet Care

The creation of an Automated Dog Nourishment Dispenser with a Microcontroller raises the following philosophical questions with regards to the application of the Internet of Things (IoT) in the pet care sector: Internet of Things also known as IoT is still a relatively young technical advancement that is attracting attention from many sectors. In the healthcare industry for instance IoT has potential in enhancing the quality of services to patients and in the overall performance. (Dang et al. 2019)[3]. The Application of Internet of Things (IoT) in Home Health 2022)[4] notes that advances in IoT-enabled healthcare such as improved chronic disease management and remote health monitoring can also be applied to pet care.

When it comes to IoT applications for aged care an increasing body of research is focused on enhancing the clinical value of IoT applications in various scenarios (Dang et al. 2019)[3]. The development of automated pet care systems that ensure effective and efficient pet nutrition can benefit from this focus on improving the utility of Internet of Things applications.

Furthermore it has been acknowledged that the integration of IoT with health management systems is a game-changer for the healthcare sector creating new business opportunities and enhancing efficiency and cost control (Buitrago et al. 2018)[5]. These benefits can be used to create automated pet feeding systems that ensure the well-being of pets while feeding them more quickly.

Since the service is able to offer fast and secure services that are data-driven and individually tailored to address the unique needs of every pet that is out there, the idea of an Automated Dog Nourishment Dispenser leveraging IoT technology can transform the pet care industry if not tomorrow then sooner. It is by considering some of the success stories, the project might use innovative ideas or implement guidelines emanating from IoT applications in health and senior care to improve the whole pet experience.

2.5 Technological Components in Automated Feeding Systems

Automated feeders are becoming more and more common in everyday pet care. The use of Internet of Things technology in the Smart Pet Feeder (SPF) is one example (Tippannavar et al. 2023)[6]. Using Internet of Things components like wireless connectivity data processing and sensors these systems efficiently automate the feeding process. Additionally studies on the energy needs of automated cattle feeding systems (Wardal et al 2021)[2]The importance of examining the technical components for sustainability and optimal performance is highlighted .

Thus after analyzing the given references it is possible to state that technological components are the very essential components that are involved in the design of stream fed automated feeding systems. Probably, several aspects of environment accuracy including feeding procedures and may all be improved through IoT technologies, sensors, and microcontrollers in different cases such as animal management and pet care. Understanding the workings of these parts is essential to make dependable and functional robotics for dispensing pet foods.

2.5.1 Microcontrollers

Microcontrollers are preferred for programming the control and management of pet feeders and their feeding regime's primary because they can enable unique programming of the amounts and timings of the same. These include the motors, sensors, and displays that make up the feeders' many parts are regulated by what is known as the Arduino or Raspberry boards. Microcontrollers have stored procedures that initiate feeding cycles to specified conditions which could be time-based or triggered by sensors that monitor food quantity/presence of a pet, etc. They may be accessed via the internet or on smartphones; they allow choice for specialized functions such as portion control, menu settings and remote device control and monitoring.

2.5.1.1 Arduino

The Arduino Uno microcontroller board is built around the ATmega328P (datasheet). Six analog inputs fourteen digital input/output pins (six of which can be used as PWM outputs) a reset button an ICSP header a power jack a USB port and a 16 MHz ceramic resonator (CSTCE16M0V53-R0) are among its features. Regarding the automation of pet care there is interest in creating an Automated Pet Nourishment Dispenser with an Arduino microcontroller specifically focusing on automatic pet feeders. Since they are so versatile and effective in a multitude of contexts Arduino microcontrollers have been used extensively in a wide range of automation systems.

González and Martín (2019)[7]have highlighted the research on the use of Arduino boards in Micro-Grid and Smart Grid automation systems emphasizing their enhancement of automation processes. Moreover an Automatic Feeder for Laying Hens based on noise amplitude that uses an Arduino Uno as its central controller demonstrates the usefulness of Arduino in animal feeding systems.

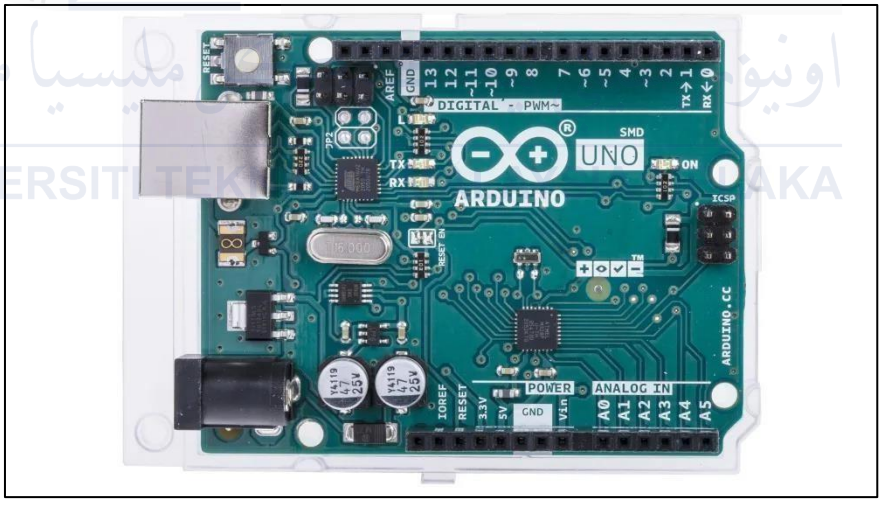


Figure 1 : Arduino

2.5.1.2 Raspberry Pi

Not only is the Raspberry Pi a cheap Linux computer but it also has some GPIO (general purpose input/output) pins that you can use to control electronic components for physical computing and experiment with the Internet of Things. Automated pet feeders that run on Raspberry Pi have grown in popularity in recent years. Because Raspberry Pi can be used to monitor and control pet care systems remotely feeding schedules are made easier and more effective (Alnoman et al. in 2019)[4] . By connecting the Raspberry Pi to the Internet and a server network customers can remotely control the feeding process via a web browser or mobile application ensuring that pets are fed precisely and on schedule.

The Raspberry Pi microcontrollers flexibility and versatility in creating intelligent and networked pet feeding systems are demonstrated by its application in automated pet feeders. Through sophisticated monitoring remote control and intelligent feeding mechanisms these projects show how the Raspberry Pi could revolutionize pet care. They are all in line with the goals of building an automated dog nutrition dispenser using a microcontroller.

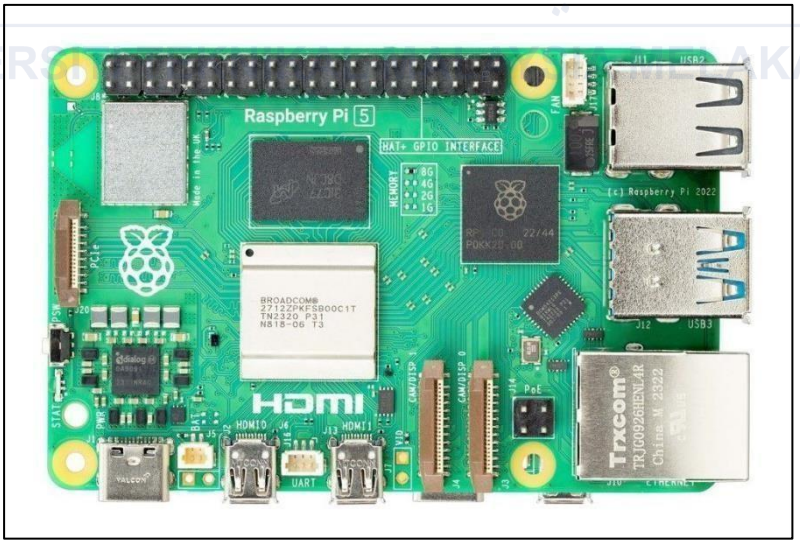


Figure 2:Raspberry Pi

Aspect	Arduino	Raspberry Pi
Personalization	Arduino boards provide the flexibility to modify software and hardware components to meet the requirements of particular projects.	More computer power and flexibility are available with Raspberry Pi, enabling complicated applications and peripheral interfaces.
Entire Community Assist	With an important and active user and development community, Arduino provides a wealth of information, guides, and libraries for both basic and complex creations.	Raspberry Pi has a large community with a wealth of resources, such as official documentation, discussion boards, and community driven projects.
Cost-Effectiveness	Since Arduino boards usually a bit cheaper than Raspberry Pi, they are appropriate for applications with a tight budget.	Though moderately more costly than Arduino, Raspberry Pi delivers exceptional value considering its capabilities, making it an affordable option for advanced applications.

Table 1 Difference between Arduino and Raspberry Pi

2.6 Sensors

In reaction to changes in their environment sensors produce electrical or visual signals. They transmit data about things like light pressure temperature and proximity acting as the machines senses. Sensors convert these inbound data into measurable signals that trigger system actions. Automatic pet feeders require sensors in order to monitor food levels detect the presence of pets and dispense food accurately and promptly.

Type of sensors:

- Weight sensor
- Proximity sensor
- Level sensor

2.6.1 Weight sensor

In order to provide precise food distribution in the feeding dispenser, weight sensors such as load cell sensors are frequently used in automated systems to detect the quantity of substances ("2020 International Conference on Information Technology Systems and Innovation (ICITSI 2020)[8]. These sensors give precise control over the feeding process by giving real-time data on the volume of food supplied.

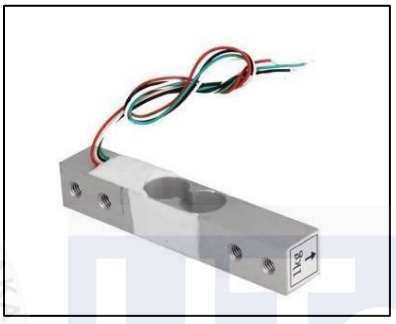


Figure 3: Weight Sensor

2.6.2 Proximity sensors

Proximity sensors which make it simpler to identify objects or barriers nearby are another essential component of automated systems. In order to prevent spills or overfilling proximity sensors can be used in conjunction with pet food dispensers to detect the presence of pets nearby (Prasad 2020)[9].

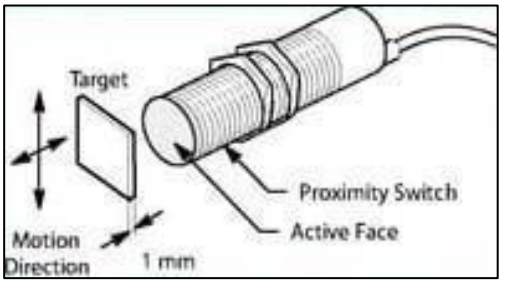


Figure 4: Proximity sensors

2.6.3 Ultrasonic sensors

The development of an automated dog food dispenser utilizing a microcontroller requires the use of ultrasonic sensors. The location of mobile autonomous robots is one of the many uses for these sensors that have shown promise (Shen et al. in 2019)[10]. For feeder automation systems ultrasonic sensors have been incorporated into centralized control systems to increase the dependability and efficiency of feeder operations (Dai 2023)[11]. In order to achieve decentralized power supply methods which have improved performance and electricity system resilience ultrasonic sensors have also been essential in distribution feeder automation planning (Huang et al. 2021)[10].

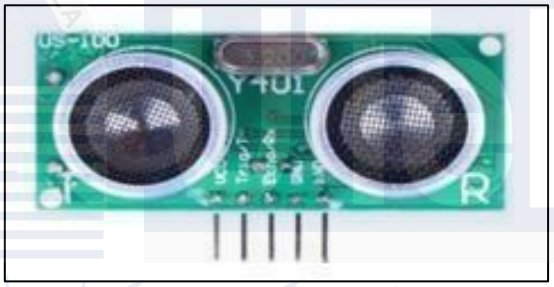


Figure 5 : Ultrasonic sensors

2.6.4 Level sensors

Level sensors are crucial for monitoring and preserving the proper amounts of food in the dispenser. Level sensors enable the system to precisely determine when the food reservoir needs to be refilled ensuring the pet always has access to food (Prasad 2020)[9].

Figure 6 : Level sensors

2.7 Relays in Automated Feeding Systems

Since relays are a prerequisite for automated pet feeding systems building an automated dog food dispenser with a microcontroller is made simpler. Electromechanical and solid state relays can be used as switches in electrical circuits. Automated pet feeding systems incorporate them to distribute power and efficiently operate motorized dispensing mechanisms (Dhakshayeni 2024)[1].

Because they can be relied upon to switch on and off relays are a great option for automated pet feeding systems. Motorized parts such as dispensing mechanisms require these switching capabilities for control. Relays are appropriate for applications that need to power motors or other high-energy devices because they can handle high-current loads. By serving as a barrier between high-voltage components and low-voltage control circuits relays also improve system safety (Ganjihal 2024)[12].

Relays are necessary for the accurate and regulated dispensing of food in the automated pet feeding industry. Automated dog food dispensers use relays to precisely control the amount and timing of food given giving the pet the best possible nutrition. As a result the pets general health and wellness are improved (Neave et al.2018)[5]. Relays also make feeding more reliable and efficient.

Relays are also used in automated pet feeding systems which supports the trend toward environments that are intelligent and adaptable. Developers can create flexible and adaptive pet feeding automation systems that are customized to meet the individual needs of each pet by integrating intelligent relay systems such as solid-state relays into the system. This flexibility improves user experience and makes integration into contemporary smart home environments easier (Jalaja et al. in 2023)[13].

Relays are essential parts of automated pet feeding systems because they provide strong safety features a high current handling capacity and dependable switching features. Relay functionality can be used to create an automated dog food dispenser which is a complex system that guarantees pets receive the right amount of food at the right time improving their overall health and wellbeing.

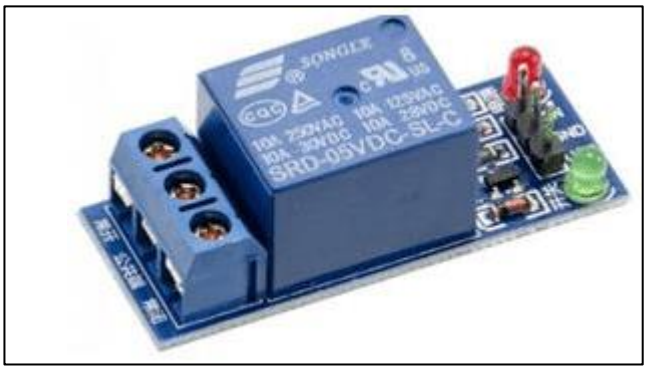


Figure 7 : Relay

2.8 Blynk App

Figure 8: Blynk App Logo

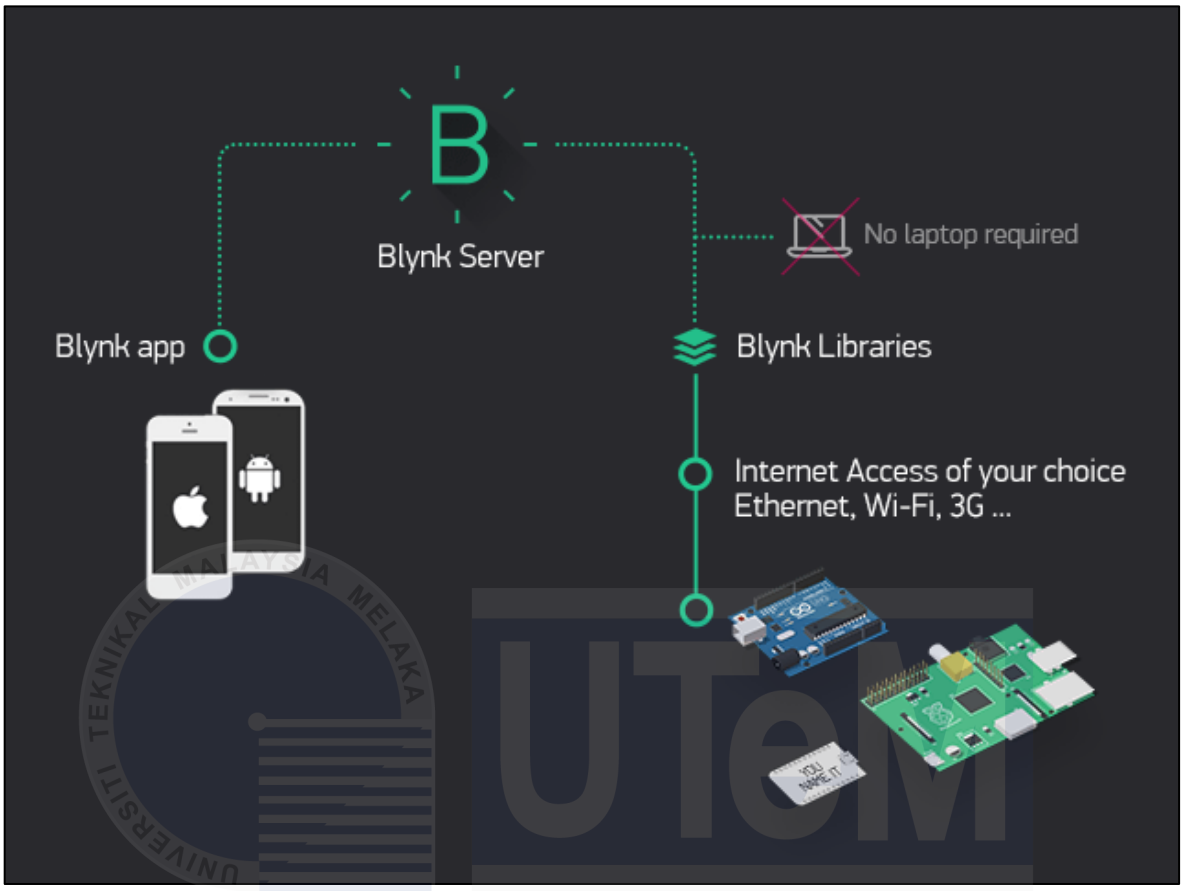


Figure 9: Blynk App Process Flow

The Blynk app is an intuitive and user-friendly platform designed for IoT (Internet of Things) projects, (Ashish et al., 2021)[14]llowing users to create custom interfaces to control and monitor connected devices remotely. Key features of the Blynk app include:

1. Interface Customization: Users can design their own interfaces or dashboards using a drag-and-drop interface builder, enabling control buttons, sliders, gauges, graphs, and other widgets to visualize and interact with connected devices.

2. Device Connectivity: The app supports various microcontrollers like Arduino, Raspberry Pi, ESP8266, and others, facilitating easy integration with a wide range of IoT hardware.

3. Cloud Connectivity: Blynk provides cloud connectivity, allowing users to remotely access and control their connected devices from anywhere with an internet connection.

4. API Integration: It provides developers with APIs to build unique features and integrations that enhance app functionality and customizability.

5. Notifications and Alerts: By configuring alerts and notifications to be sent in response to certain events or conditions users can get real-time information and warnings about connected devices.

6. Energy Efficiency: Blynk uses a cost-effective and flexible energy-based model that requires an energy point for each widget used on the interface.

7. Community and Sharing: By encouraging users to share their ideas projects and code snippets, it creates a community that helps IoT enthusiasts collaborate and learn from each other. With a user-friendly interface that makes it easy to create, manage and track IoT projects from a mobile device, the Blynk app is a powerful tool for Internet of Things enthusiasts and developers.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This project uses the Blynk app to build an Internet of Things (IoT) dog food sprinkler that operates on a microcontroller. By applying this sort of technology, dog owners might be able to control their pet's points of consumption of water and food from a distance. Not only does the dispenser provide fresh water in abundance and on a regular basis, it also mixes food at certain times and portions as programmed with the help of an application. Another element of the creation is a water supply regulated with the water level sensor and the weight sensor measuring the food supplied by the system.

3.2 Flow Chart

The automatic dog food dispenser system initially configures its Wi-Fi after establishing a connection with the Blynk app. Using the Blynk app, users can adjust the nutrition schedule and portion sizes. Users must first fill the water reservoir and food dispenser according to the system. When the food is ready to dispense a weight sensor is used by the microcontroller to weigh the food in the bowl. The microcontroller then monitors the feeding schedule and dispenses food until the target amount is reached. Using the Blynk app, the food balance is updated. Also, if the water in the water dish is low, the system will automatically refill it by monitoring the level. By displaying these updates continuously, the Blynk app gives users access to real-time system monitoring. A common practice to ensure a dog gets food and water when it needs it is to check the feeding schedule.

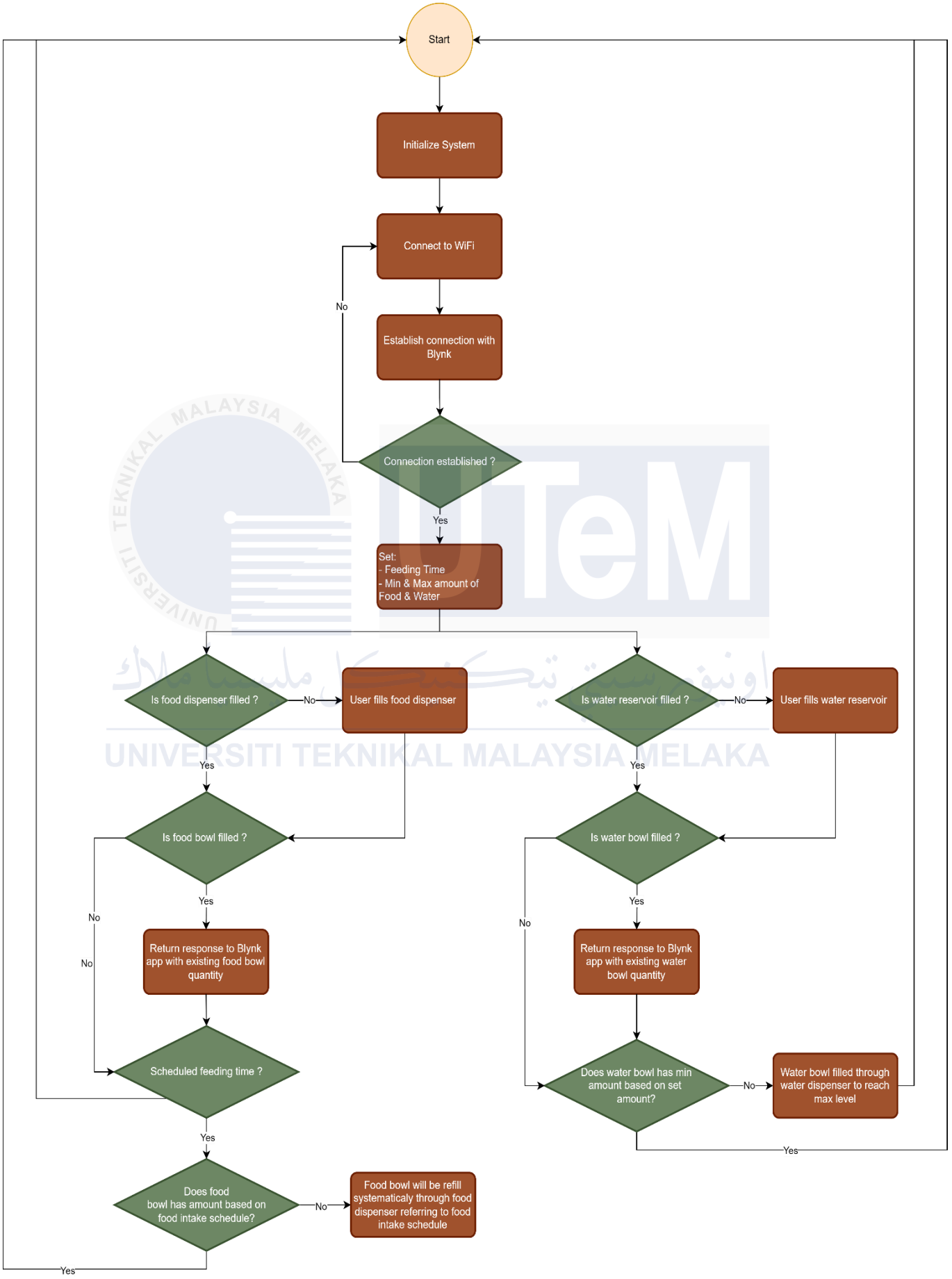
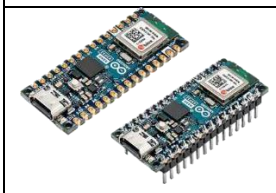


Figure 10:FlowChart

3.2.1 Componenets

Components	Name	Quantity
	Arduino ESP 32 RM 30.00	1
	Servo Motor Rm 6.50	1
	Weight Sensor Rm14.90	1
	Water level sensor Rm 4.00	1

	Water flow sensor Rm 10.00	1
	Ultrasonic Sensor Rm 4.00	2

Table 2 List of Componenets

3.2.2 System Initialization

During system initialization the microcontroller is first connected to a Wi-Fi network to enable connection with the Blynk app. To accomplish this establish a reliable connection and give the microcontroller the network credentials. The microcontroller establishes a link with the Blynk app using its authentication token after connecting enabling remote control and monitoring. Next the linked actuators and sensors are all set to their initial values. To ensure precise performance the food dispenser mechanism must be configured the weight sensor must be calibrated to measure the food precisely and the water level sensor must be adjusted to detect the water level in the bowl. This initialization process provides a strong foundation for the automated nutrition system by guaranteeing that every component is set up correctly and ready for use.

3.2.3 User Interaction via Blynk App

The users interaction with the automatic dog food dispenser via the Blynk app is a must. The user-friendly interface of the app allows users to set up precise feeding schedules and select the precise quantity of food to be given at each feeding time. These modifications are wirelessly transferred to the dispenser systems microcontroller. After receiving these parameters the microprocessor stores them to ensure that the food is delivered exactly as per the users instructions. Pet owners now have a convenient and efficient way to monitor their dogs nutrition from a distance thanks to the microcontrollers easy communication with the Blynk app.

3.2.4 Food Dispensing Mechanism

At predetermined feeding times and amount of food that are configured using the Blynk app, the microcontroller triggers the food distribution mechanism. First, the weight of the meal is initially measured by the weight sensor under the bowl. Then, the food is dispensed into the bowl by the microcontroller, starting the dispensing procedure. This process continues until the weight sensor determines that the meal has been distributed in the amount that was specified. The microprocessor keeps an eye on the weight throughout this procedure to guarantee accurate dispensing. The system logs the event for the user's records, and pauses the dispenser, This guarantees precise and steady feeding according to the quantity and schedule that the user specifies.

3.2.5 Water Refilling Mechanism

The water bowl is continuously filled thanks to the water refill mechanism in the automated dog food dispenser. A water level sensor like an ultrasonic or float sensor keeps an eye on the water level in the bowl continuously. When it detects that the water level has fallen below a predetermined threshold the sensor notifies the microcontroller to activate the water pump. When the sensor indicates that the water level is sufficient the pump then fills the bowl with water again from a reservoir. The system communicates with the Blynk app which logs the refilling event and updates the app with the current water level enabling the user to remotely monitor and control their pets water supply.

3.2.6 Monitoring and Alerts

The Blynk app enables pet owners to check the status of their pets food and water levels in real time from any location at any time. Its user-customizable alerts and notifications alert the user to critical issues such as low food or water bowls that are empty or issues with the dispensing mechanism. By promptly resolving any problems this proactive alarm system guarantees that the pets needs are met without delay and contributes to the maintenance of consistent pet care.

3.2.7 Service

The Blynk app reminds you to regularly refill the water tank and food sprinkler as part of routine system maintenance. To avoid clogging and maintain cleanliness, users are also advised to clean the water tank and sprinkler mechanism periodically. This simple maintenance procedure is important for the durability and proper operation of this system, which benefits the general health of the pet.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

The common issue that people face when it comes to feeding the dog and giving the dog water at correct time intervals has been resolved Development of an Automated Dog Nourishment Dispenser Using Microcontroller project. The selection of equipment includes the ESP32 microcontroller that controls and is linked to the Blynk smartphone application for feeding instructions and monitoring. Other crucial parts consist of a relay module that manages the circuit for the sprinkler, and a water sensor to check the presence of water, an ultrasonic sensor to detect food level, and a load cell to measure the food in question adequately. This method enables pet feeding to be consistent, and remote observation of the feeding process results in improved efficiency in the delivery of care and comfort to pets.

Figure 11 Prototype

4.2 Characteristics Development of an Automated Dog Nourishment Dispenser Using Microcontroller

4.2.1 Technological Characteristics

Microcontroller-Based Automation	The whole system is based on an ESP32 microcontroller, which provides functionality to efficiently act on the automated feeding and watering processes. Microcontroller is very well compatible for interfacing with IoT Platforms such as the Blynk app, to monitor and control in real-time.
Sensor Integration	**Weight Sensors**: Measures the actual weight of dispensed food, thus providing a high degree of assurance in terms of portion control during feeding sessions. **Water Level Sensors:** These sensors ensure in-house supply and attach conditions that trigger automatic refills by detecting low levels of water. **Ultrasonic Sensors:** These sensors keep a record of food levels in the storage container, which alerts users when it requires replenishment.
IoT Connectivity	It allows pet owners to monitor the entire system actions from afar through the Blynk app, low food or water levels notifications and accurate feeding times.

4.3 Food Dispenser System

The food dispenser system automates the process of delivering the correct amount of food at scheduled times, ensuring consistent and accurate feeding. The table below explains the components and their respective characteristics.

Figure 12 Food Dispenser

Components	Characteristics
ESP32 Microcontroller	Handling food dispensing by managing data from sensors as well as controlling the servo motor.
Servo Motor	Operates the food dispensing mechanism by controlling the opening and closing of the outlet to ensure precise food portions.
Weight Sensor(Load Cell)	Measures the weight of the dispensed food in real-time, ensuring accurate portion control and preventing overfeeding or underfeeding .
Ultrasonic Sensor	Detects the level of food in the storage container and notifies the owner via the Blynk app when food needs to be refilled .
Food Storage Reservoir	Holds the dry food supply .Designed for smooth and controlled flow into the dispensing mechanism
Blynk App	Allows users to set feeding schedules , monitor food dispensing, and receive alert for low food levels

4.4 Water Dispenser System

A feature of the water dispenser is where it automatically fills the bowl when the water level descends to a level determined for pets. The components, their features, and functionalities are captured in the table below:

Figure 13 Water Dispenser

ESP32 Microcontroller	Manages the water dispensing process by processing input from sensors and controlling the water pump .Enables communication with the Blynk app for monitoring.
Water Pump	Transfers water from the reservoir to the bowl when the microcontroller detects a low water level
Water Level Sensor	Detects the water level in the bowl and sends signals to the microcontroller to trigger or stop the pump.
Blynk App	Provides users with notifications when the water level is low and allows remote monitoring of the system's operation
Water Storage Resavoir	Holds the water supply for dispensing.

4.5 Blynk Interface

The Development of an Automated Pet Feeder Using Microcontroller contains a Blynk interface to allow particular access to the system linked to the smart pet feeder in real-time. The time to feeding for the pets can be preset by the user. The food quantity intended for dispensing can also be modified as it could be inputted via a different field related to food weight. The real-time monitoring features include the display of food and water levels in the bowls using circular gauges, plus indicators for knowing the storage levels for food and water tank levels to track reserves easily. You can also link up alerts to notify the users on the low-laying storage. This interface makes pet care foolproof by affording it remote control, customization, and feedback mechanisms in feeding and watering pets consistently without having to do it all manually.

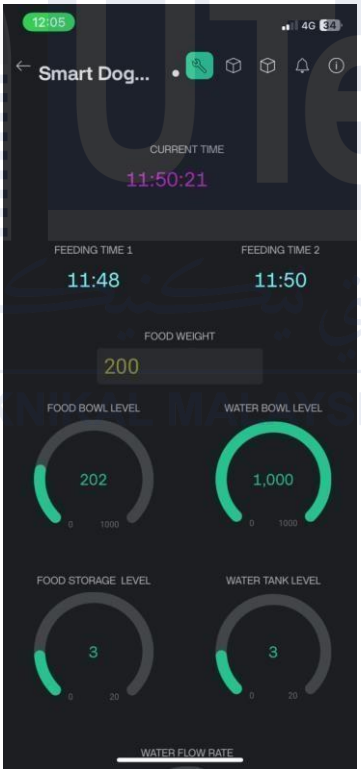


Figure 14 Blynk Interface

4.6 Circuit Diagram

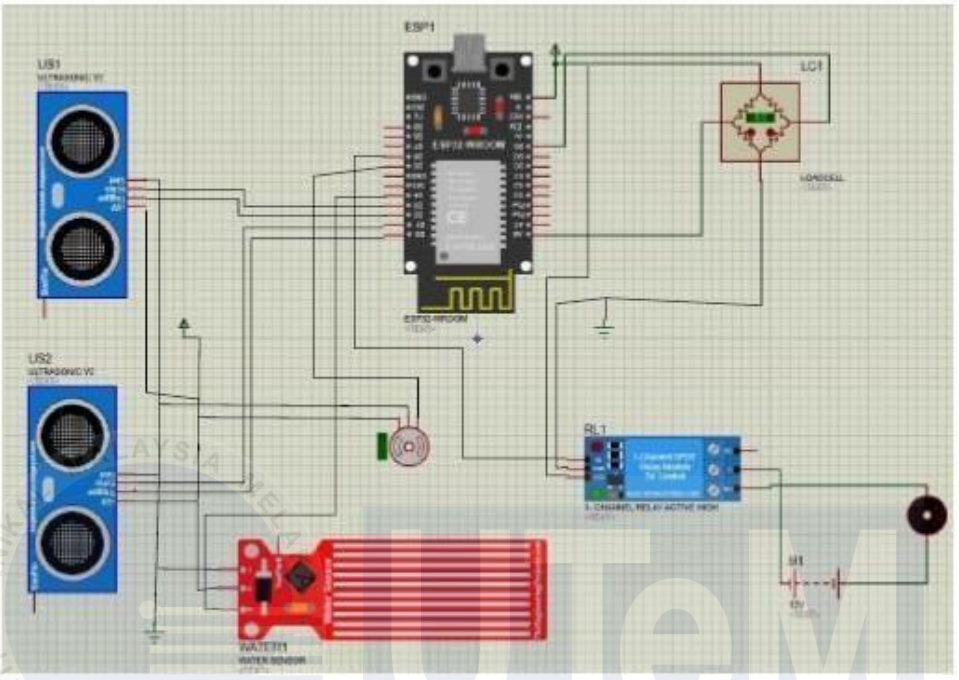
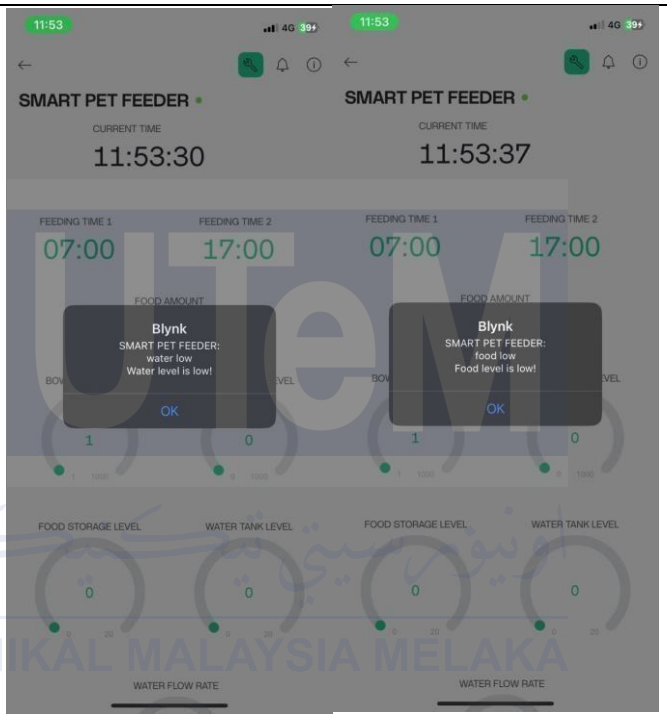


Figure 15 Circuit Diagram

4.7 Result

Test Run 1

This test scenario evaluates the system's response when both the food and water bowls are empty. The goal is to verify the functionality of the sensors, dispensing mechanisms, and the communication system to ensure accurate and timely refills.

Blynk App	 When the stock of food and water is reduced to a minimum (Level 2), the Blynk app sends a notification to the user.

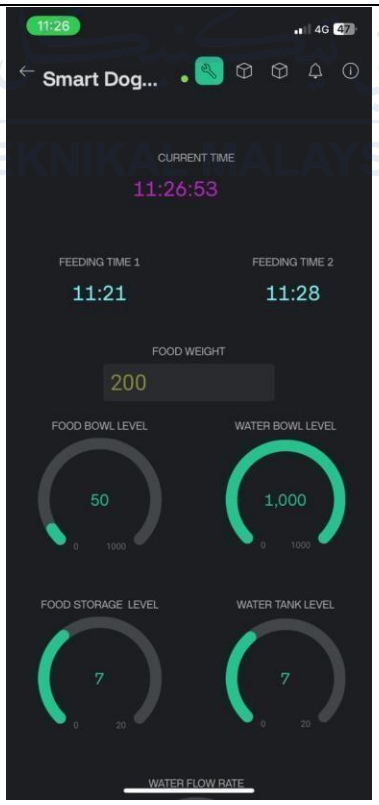
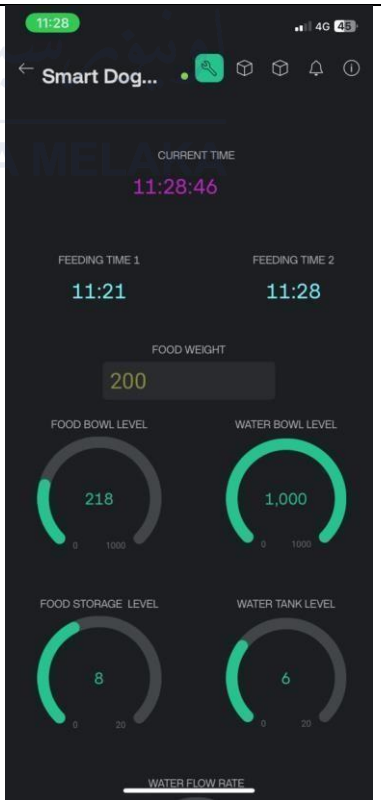
Test Run 2

This test scenario evaluates the system's response when the food bowl and water level are already full. The purpose is to ensure that the system does not unnecessarily activate dispensing mechanisms and maintains system stability without triggering false alerts.

Amount of food and water dispence	 The food level set to 200g, and the water has refilled automatically base on the water level sensor
Blynk App	

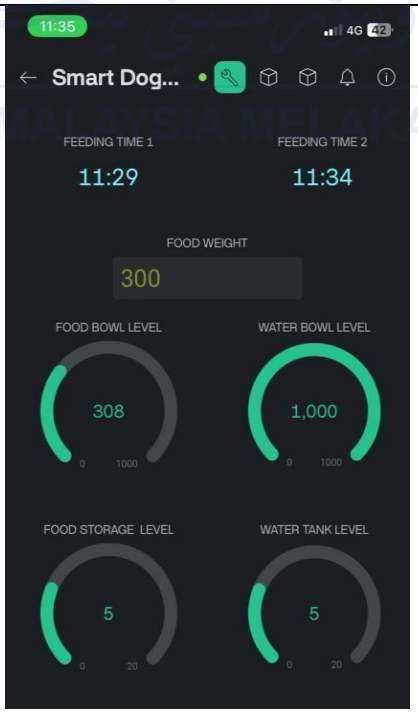
Test Run 3

This test scenario evaluates the system's response when there is 50g of food remaining in the food bowl.The remaining 150g will be refilled at the next feeding time.The purpose is to ensure that the system accurately monitors food level and maintains stability without triggering unnecessary dispensing or false alert.

Amount of food and water dispence	  BEFORE AFTER
Blynk App	  BEFORE AFTER

Test Run 4

This test scenario evaluates the system's responce when the food amount is set to 300g.The purpose is to ensure the system accurately dispenses the configured amount of food during each feeding time whitout errors.

Amount of food and water dispence	 300g of food have dispenced.
Blynk Interface	

4.8 Summary

The problem of keeping dogs eating and drinking consistently can be solved with the help of the Automated Dog Nourishment Dispenser Using Microcontroller project. The ESP32 microcontroller is connected with the Blynk smartphone app to automate and monitor the feeding process. Important components include a relay module to control the sprinkler mechanism, a water sensor to monitor water availability, an ultrasonic sensor for food level detection, and a load cell for accurate food measurement. This method ensures that pets receive consistent nutrition and allows owners to monitor and manage nutrition remotely, increasing the effectiveness and comfort of pet care.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The Development of an Automated Dog Nourishment Dispenser Using a Microcontroller address the challenges of maintaning regular feeding and hydrating schedules for dog. The system incorporates high-end sensors, for example a load sensor, which allows measuring the food accurately, and another in water that regulates the hydration automatically. A shedding cycle is set in grams of food; the remainder is dispensed in another cycle ensuring controlled dispensing.

Integration with the Blynk application will allow dog owners to set a feeding schedule remotely, monitor the food and water levels in real time and be alerted when supplies run low or they have been replenished. Thus, dogs see to it that they eat well and drink enough even if their owners are not around.

An automated IoT-based solution for dog care that saves the user value while improving the dog's quality of life at the same time, which shows the strength of robotic systems in modern-day pet care.

5.2 Future Works

I. Set up a camera system to monitor the dog when away from home,providing real time video feeds for pets owners.
II. Enhance IoT capabilities to connect with other smart home devices for comprehensive pet monitoring.
III. Develop multi-pet management features using RFID or facial recognition to dispense food accurately for each pet.
IV. Create a specific app for this project,allowing users to track pet activities,feeding schedules,troublebleshoot problem and health data .
V. Add health monitoring sensors to track pets' weight and activity, adjusting diet plans and alerting owners to health issues.

Citation And References

[1] D. Dhakshayeni and Dr. S. Rathinavel, "Automated food feeder for dogs using embedded device," *International Journal of Research Publication and Reviews*, vol. 5, no. 4, pp. 1074–1077, Apr. 2024, doi: 10.55248/gengpi.5.0424.0933.

[2] W. J. Wardal, K. E. Mazur, K. Roman, M. Roman, and M. Majchrzak, "Assessment of cumulative energy needs for chosen technologies of cattle feeding in barns with conventional (Cfs) and automated feeding systems (afs)," *Energies (Basel)*, vol. 14, no. 24, Dec. 2021, doi: 10.3390/en14248584.

[3] R. Hakim Ash Shiddieqy, B. Adhi Saputro, F. Odhi Dandha, and L. Rusdiyana, "Automated Pet Feeder using 3D Printer with Opened Source Control System," 2020.

[4] M. Willis, P. Duckworth, A. Coulter, E. T. Meyer, and M. Osborne, "The Future of Health Care: Protocol for Measuring the Potential of Task Automation Grounded in the National Health Service Primary Care System," *JMIR Res Protoc*, vol. 8, no. 4, Apr. 2019, doi: 10.2196/11232.

[5] L. Minh Dang, M. J. Piran, D. Han, K. Min, and H. Moon, "A survey on internet of things and cloud computing for healthcare," *Electronics (Switzerland)*, vol. 8, no. 7, Jul. 2019, doi: 10.3390/electronics8070768.

[6] A. Alnoman, S. K. Sharma, W. Ejaz, and A. Anpalagan, "Emerging edge computing technologies for distributed IoT systems," *IEEE Netw*, vol. 33, no. 6, pp. 140–147, Nov. 2019, doi: 10.1109/MNET.2019.1800543.

[7] H. W. Neave, D. M. Weary, and M. A. G. Von Keyserlingk, "Review: Individual variability in feeding behaviour of domesticated ruminants," *Animal*, vol. 12, no. s2, pp. s419–s430, Jan. 2018, doi: 10.1017/S1751731118001325.

[8] S. S. Tippannavar, R. G, R. Jain, and P. Golasangi, "SPF: Smart Pet Feeder using IoT for Day-to-Day Usage," *Int J Res Appl Sci Eng Technol*, vol. 11, no. 1, pp. 299–304, Jan. 2023, doi: 10.22214/ijraset.2023.48403.

[9] I. González and A. J. Calderón, "Integration of open source hardware Arduino platform in automation systems applied to Smart Grids/Micro-Grids," *Sustainable Energy Technologies and Assessments*, vol. 36, p. 100557, Dec. 2019, doi: 10.1016/J.SETA.2019.100557.

[10] I. Agape, A. I. Dontu, A. Maftei, L. Gaiginschi, and P. D. Barsanescu, "Actual types of sensors used for weighing in motion," in *IOP Conference Series: Materials Science and Engineering*, Institute of Physics Publishing, Aug. 2019. doi: 10.1088/1757-899X/572/1/012102.

[11] M. Prasad, "Cost Effective IoT based Automated Fish Farming System with Flood Prediction," *International Journal of Advanced Trends in Computer Science and Engineering*, vol. 9, no. 1.3, pp. 291–297, Jun. 2020, doi: 10.30534/ijatcse/2020/4491.32020.

[12] M. Shen, Y. Wang, Y. Jiang, H. Ji, B. Wang, and Z. Huang, "A new positioning method based on multiple ultrasonic sensors for autonomous mobile robot," *Sensors (Switzerland)*, vol. 20, no. 1, Jan. 2020, doi: 10.3390/s20010017.

[13] Y. Dai, D. Li, Y. Chen, and M. Tang, "Automatic Relay Protection Calibration Device and System Design for New Intelligent Power Grid," *J Phys Conf Ser*, vol. 2560, no. 1, 2023, doi: 10.1088/1742-6596/2560/1/012031.

[14] R. B. R, S. V C, and P. Ganjihal, “Automatic Pet Food Dispenser using Digital Image Processing.” [Online]. Available: www.ijert.org
[15] R. Ravindran Unnithan Jalaja and R. R. J, “Performance Analysis of Spatial Modulation in Cooperative Cognitive Radio Networks with Energy Harvesting,” 2023, doi: 10.21203/rs.3.rs-2076856/v1.
[16] “Blynk Controlled Automatic Pet Feeder with Timer.” Accessed: Jun. 09, 2024. [Online]. Available: https://circuitdigest.com/microcontroller-projects/blynk-controlled-automatic-pet-feeder-with-timer
[17] I. Meyer and B. Forkman, “Dog and owner characteristics affecting the dog–owner relationship,” *Journal of Veterinary Behavior*, vol. 9, no. 4, pp. 143–150, Jul. 2014, doi: https://doi.org/10.1016/j.jveb.2014.03.002.
[18] Lim and J. Yin, “DESIGN AND DEVELOPMENT OF 2-IN-1 AUTOMATIC PETFEEDER.”Available:https://eprints.usm.my/54163/1/Design%20And%20Development%20Of%202In1%20Automatic%20Pet%20Feeder_Lim%20Joe%20Yin_M4_2018.pdf
[19] R. H. A. Shiddieqy, B. A. Saputro, F. O. Dandha, and L. - Rusdiyana, “Automated Pet Feeder Called Smart Pakan using 3D Printer with Open Source Control System,” *IPTEK The Journal of Engineering*, vol. 6, no. 2, pp. 58–62, Jan. 2021, doi: https://doi.org/10.12962/j23378557.v6i3.a7896.