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BDA Outer Ring Road, Mallathalli, Bengaluru – 560056

Aided By Govt. of Karnataka

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

A Project Report

On

"IOT BASED AUTOMATIC PET FEEDER"

Submitted in partial fulfillment of the requirement for the award of the Degree of

BACHELOR OF ENGINEERING

By

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CERTIFICATE

Certified that the project work titled **"IOT BASED AUTOMATIC PET FEEDER"** carried out by Mr. Jeevan G N bearing 1DA20EC054, Mr. Karan R Gowda bearing 1DA20EC059, Mr. Madhu K M bearing 1DA20EC071, Mr. Manohar R bearing 1DA20EC076, a bonafide student of Dr. Ambedkar Institute of Technology, Bengaluru , in partial fulfillment for the award of Degree in Electronics and communication engineering of Dr. Ambedkar Institute of Technology, Bengaluru during the year 2024. It is certified that all corrections/suggestions indicated during Internal Assessment have been incorporated in the report deposited in the department. The project report has been approved as it satisfies the academic requirements in respect of project work prescribed for the said Degree.

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Viva-Voice Examination

Name of the Examiners	Signature with Date
1	
2.	

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Declaration

I hereby declare that the matter embodied in this Project is the result of research work carried out by me at the Department of Electronics and communication engineering, **Dr. Ambedkar Institute of Technology**, Bengaluru under the supervision of **Manjula N**, Assistant Professor, Department of Electronics and communication engineering. The dissertation report or part thereof has not been submitted for the award of any degree, diploma, fellowship etc., of any other university or institute.

Place: Bengaluru

Date:

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I would like to thank my parents and friends who helped me with their valuable suggestions and guidance toward the completion of the project.

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ABSTRACT

The project presents a comprehensive system for automated pet feeding, utilizing advanced animal detection and recognition technologies to ensure precise and timely feeding of pets. The core of the system integrates ultrasonic sensors for initial pet detection and a convolutional neural network (CNN) for accurate pet recognition, ensuring that only the designated pet receives the food. The automated feeding mechanism, controlled by a DC motor and H-Bridge setup, precisely dispenses food portions, monitored by a load cell to maintain dietary control.

Key features include remote monitoring and notifications via Twilio API and Telegram, providing real-time updates to pet owners on successful feedings and low food levels. The system's hardware is built around the Arduino IDE and NodeMCU ESP8266, ensuring reliable performance and ease of integration.

Initial testing showed high accuracy in pet detection and recognition, efficient food dispensing, and stable system operation. Despite occasional false positives due to environmental factors and the dependency on stable internet connectivity, the system performed reliably over extended periods. User feedback highlighted the convenience of remote monitoring and suggested improvements in user interface design.

This project offers significant potential for enhancing pet care through automation and remote monitoring. Future improvements could include more sophisticated image recognition algorithms, battery backup for increased reliability, and integration with other smart home devices. Overall, this automated pet feeding system represents a significant step forward in pet care technology, providing convenience, reliability, and precise dietary control for pets.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

In today's fast-paced world, people often find themselves busier than ever, leading to the neglect of various responsibilities, including pet care. Many individuals desire pets for their appealing appearance, loyalty, and playful personalities, but maintaining a pet requires commitment, which can sometimes be overlooked due to a hectic schedule. Feeding pets is a crucial aspect of pet care that often becomes a challenge for busy pet owners. This project introduces an IoT-based automatic pet feeder to address the issue of feeding pets when owners are away or unable to manage it remotely. Utilizing digital image processing, the food dispenser activates upon pet detection and recognition, ensuring pets receive their meals without human intervention.

The primary objective of this project is to provide a simpler and more efficient way for pet owners to feed their pets, ensuring that even in their absence, their pets are well-cared for. The system automatically detects and recognizes individual pets, matches detected pets with their stored profiles, and dispenses the appropriate type and amount of food tailored to each pet's needs. Designed to support pets from various species, the intelligent pet feeder includes separate food containers and plates for different types of food, allowing owners to cater to the dietary requirements of multiple pets.

This project leverages the field of Computer Vision, inspired by the goal of enabling machines to perceive the world as humans do. By employing advanced techniques such as image and video recognition, image analysis, and classification, the pet feeder uses deep learning algorithms, particularly Convolutional Neural Networks (CNNs), to achieve precise pet detection and recognition. Beyond the convenience it offers to pet owners, the automatic pet feeder also promotes better pet health. By ensuring that pets receive the correct type and amount of food at regular intervals, it helps prevent issues such as overeating or underfeeding, which are common problems with manual feeding. Additionally, the system's ability to cater to multiple pets with different dietary needs makes it a versatile solution for households with more than one pet, ensuring each pet's nutritional requirements are met.

Moreover, the integration of IoT technology allows for potential enhancements such as remote monitoring and control via a smartphone app. This feature can provide pet

owners with real-time updates on their pets' feeding schedules and alert them to any issues, offering peace of mind even when they are away from home. As advancements in IoT and AI continue to evolve, the capabilities of such systems are expected to expand, making pet care even more efficient and effective.

In summary, this IoT-based automatic pet feeder not only alleviates the burden on pet owners but also ensures that pets are fed timely and appropriately, enhancing the overall pet care experience. By combining the latest developments in Computer Vision and IoT technology, this project represents a significant step forward in automated pet care solutions, offering both convenience and peace of mind for pet owners while promoting the health and well-being of their pets.

1.2 History

The concept of automatic pet feeders is not new, but their evolution has been significantly shaped by advancements in technology, particularly in the realms of the Internet of Things (IoT) and artificial intelligence (AI).

Early Beginnings

Automatic pet feeders began as simple mechanical devices designed to dispense food at set intervals. These early models relied on basic timers and mechanical systems, offering a rudimentary solution for pet owners who needed a way to feed their pets in their absence. While functional, these feeders lacked sophistication and adaptability, providing a one-size-fits-all approach that did not account for the specific needs of different pets.

Introduction of Electronics and Basic Automation

With the advent of electronics, automatic pet feeders saw the integration of digital timers and programmable settings. These advancements allowed for more precise control over feeding schedules and portions. However, these feeders were still relatively limited in their functionality, often requiring manual input and lacking the ability to adapt to the individual needs of pets.

The Rise of IoT and Smart Technologies

The true revolution in automatic pet feeders began with the rise of IoT and smart technologies. IoT enabled the connectivity of everyday devices to the internet, allowing

for remote control and monitoring. This shift opened up new possibilities for pet feeders, transforming them from basic automated devices to sophisticated smart systems.

Integration of IoT in Pet Feeders

IoT-based pet feeders began to emerge, offering features such as remote scheduling and real-time monitoring via smartphone apps. These feeders allowed pet owners to manage feeding times, monitor food levels, and even receive alerts when it was time to refill the food container, all from their mobile devices. This integration significantly enhanced the convenience and control available to pet owners.

Advent of AI and Machine Learning

The incorporation of AI and machine learning took automatic pet feeders to the next level. Advanced systems began to utilize AI for more precise and tailored feeding. For example, AI algorithms could analyze a pet's eating habits and adjust feeding schedules and portions accordingly. Machine learning enabled these systems to learn from the behavior and preferences of individual pets, offering a more personalized feeding experience.

Computer Vision and Deep Learning

The latest advancements in automatic pet feeders involve the use of computer vision and deep learning. By integrating cameras and image recognition technology, these feeders can now identify specific pets, ensuring that the correct type and amount of food is dispensed for each pet. This capability is particularly useful in multi-pet households where different pets may have distinct dietary needs. Convolutional Neural Networks (CNNs), a type of deep learning algorithm, play a crucial role in achieving high accuracy in pet detection and recognition.

Current State and Future Prospects

Today, IoT-based automatic pet feeders are highly sophisticated devices that offer a range of features designed to make pet care easier and more effective. They can dispense food based on real-time pet detection, provide detailed feeding logs, and even integrate with other smart home devices. Looking forward, the future of these feeders will likely include further advancements in AI, such as predictive analytics to anticipate a pet's needs, and even greater integration with smart home ecosystems.

In conclusion, the evolution of automatic pet feeders from simple mechanical devices to advanced IoT-enabled systems showcases the profound impact of technological advancements. These feeders have become indispensable tools for modern pet owners, offering unprecedented levels of convenience, precision, and adaptability in pet care.

1.3 Classification

IoT-based automatic pet feeders can be classified based on their features, functionality, and underlying technology. Basic timed feeders represent the simplest form, using mechanical or electronic timers to dispense pre-set amounts of food at scheduled times, suitable for pet owners who need regular feeding intervals without remote control. More advanced are the smart feeders with IoT connectivity, which integrate Wi-Fi or Bluetooth to enable remote control and monitoring via smartphone apps, providing real-time notifications and manual feeding options for tech-savvy owners. Feeders with portion control and customization offer precise management of food amounts, allowing for multi-meal scheduling and tailored feeding plans, ideal for pets with specific dietary needs or owners looking to prevent overfeeding. Multi-pet feeders take it a step further by incorporating pet recognition technology, such as cameras and image recognition, to identify individual pets and dispense the appropriate food, perfect for households with diverse pet dietary requirements.

Some feeders also include health monitoring features, using weight sensors and data analytics to track and analyze feeding habits and overall pet health, catering to owners who want to closely monitor their pets' well-being. AI-powered feeders utilize advanced machine learning algorithms to adapt feeding schedules and portions based on pets' habits and preferences, offering a high-tech, personalized feeding solution.

Integrated smart home feeders, part of a broader smart home ecosystem, work with other devices like Alexa or Google Home for enhanced functionality, providing voice control and automation routines for a cohesive pet care solution. Lastly, emergency feeders with backup power, such as battery or solar options, ensure continuous operation during power outages, making them essential for owners in areas prone to disruptions or those needing a highly reliable feeding system.

These classifications illustrate the diverse range of IoT-based automatic pet feeders available, each addressing different aspects of pet care to meet the varying needs of pet owners, from basic automated feeding to sophisticated AI-driven solutions.

1.4 Problem Statement

Pet owners often face significant challenges in maintaining a consistent and healthy feeding routine for their pets due to their busy schedules and various commitments. These challenges can lead to several critical issues that impact both the pets' health and the owners' peace of mind.

Firstly, many pet owners feed their pets late because they are too occupied with their work. This inconsistency can disrupt the pets' meal routines, leading to potential health issues such as digestive problems and behavioral changes.

Secondly, pets often do not get enough food when their owners need to work outstation or travel frequently. In such cases, relying on neighbors or friends to feed the pets may not always be reliable, resulting in missed meals or improper feeding.

Additionally, owners sometimes forget to feed their pets on time due to their hectic lifestyles. This oversight can disturb the pets' established meal routines and adversely affect their health, causing stress and anxiety for both the pets and their owners.

Moreover, sick pets require special diets and careful attention, which can be time-consuming and costly for pet owners. Ensuring that the correct pet receives the right medication or special food can be challenging, especially in households with multiple pets. Currently, no product on the market fully addresses these specific needs, leaving a gap in effective pet care solutions.

To tackle these issues, there is a clear need for an innovative solution that can automate and manage pet feeding efficiently. The IoT-based automatic pet feeder aims to fill this gap by providing a reliable, intelligent system that ensures pets are fed accurately and on time, even in the owner's absence. This feeder will leverage advanced technologies such as IoT, AI, and computer vision to deliver personalized feeding plans, monitor pet health, and provide remote control capabilities, thereby enhancing the overall well-being of pets and offering convenience and peace of mind to pet owners.

1.5 Objectives

The IoT-based automatic pet feeder project aims to achieve several key objectives, ensuring that pet care is more efficient, reliable, and tailored to the needs of individual pets and their owners. The main objectives are:

- Automate Pet Feeding: Develop a system that can automatically dispense the correct amount of food at scheduled times, reducing the need for manual feeding and ensuring pets are fed even when their owners are not home.

- Enhance Convenience for Pet Owners: Provide a user-friendly interface, accessible via a smartphone app, that allows pet owners to control and monitor the feeder remotely. This includes setting feeding schedules, adjusting portion sizes, and receiving notifications.

- Personalize Feeding Plans: Utilize digital image processing and AI to recognize individual pets and match them with their stored profiles, dispensing the appropriate type and amount of food for each pet. This is particularly useful for households with multiple pets that have different dietary needs.

- Support Multiple Pet Species: Design the feeder to accommodate various species by having separate food containers and plates, enabling the storage and dispensing of different types of food suitable for different pets.

- Monitor and Track Feeding Habits: Integrate health monitoring features such as weight sensors and data analytics to track pets' feeding patterns, helping owners ensure their pets are eating properly and identifying any potential health issues.
- Ensure Reliability and Continuity: Incorporate backup power solutions like battery or solar options to ensure the feeder continues to operate during power outages, providing uninterrupted service and peace of mind for pet owners.

- Improve Pet Health and Well-being: Promote better pet health by preventing issues like overeating or underfeeding, ensuring pets receive the right amount of food at the right times, and tailoring feeding schedules based on individual needs.

- Leverage Advanced Technologies: Utilize cutting-edge technologies such as IoT, AI, and computer vision to enhance the functionality, accuracy, and reliability of the feeder, setting a new standard for automated pet care solutions.

CHAPTER 2
LITERATURE SURVEY

Numerous studies and innovations have been conducted in the field of automatic pet feeders, incorporating various technologies to improve the convenience and efficiency of pet care.

1. Intelligent Food Dispenser (IFD)

Authored by Hari N. Khatavkar, Rahul S. Kini, Suyash K. Pandey, and Vaibhav V. Gijare in 2019, this food dispenser is controlled using an Android application that communicates with the device through a Wi-Fi module. The microcontroller FRDM KL25Z is programmed to operate a motor that controls the dispensing mechanism. The food storage box has an opening and a lid, which is moved by a DC motor interfaced with the FRDM board. The duration for which the lid and storage box openings coincide determines the amount of food dispensed. After dispensing, the motor rotates to close the lid. The Android app allows precise control over how long the motor stays in the opening position. Image processing plays a crucial role in this system, enhancing real-time functionality.

2. Automatic Pet Feeder

Aasavari Kank and Anjali Jakhariye (2018) designed a system employing various sensors for efficient pet feeding. A proximity sensor connected to an Arduino detects when a pet is near the feeder, triggering the release of food from a container into a bowl. A servo motor is used to lock and unlock the food dispenser. The system ensures that food is dispensed whenever the pet approaches, improving feeding efficiency.

3. Pet Feeding Dispenser Using Arduino and GSM Technology

Authored by Smruthi Kumar in 2018, this system allows pet owners to feed their pets remotely by sending a text message to the system via GSM technology. Upon receiving the message, a solenoid valve and servo motor activate to dispense food. The system also allows water to flow freely by opening a valve. After feeding, the owner receives a confirmation message. This solution is ideal for busy families who cannot always be home to feed their pets.

4. Automatic Pet Monitoring and Feeding System Using IoT

In 2017, Subaashri S, Sowndarya M, Sowmiyalaxmi D K S, Sivassan S V, and Rajasekaran C proposed an IoT-based system that integrates hardware and software for efficient data access. It uses a SOAP-dependent mechanism with web services to manage devices. Sensors monitor various pet activities, and an RFID tag on the pet collar transmits identity information. An Arduino gateway sends collected data to cloud storage, accessible via a smartphone. The wireless network ensures reliable data transmission, and the system can be enhanced with real-time clocks for better scheduling.

5. Remote Controlled and GSM-Based Automated Pet Feeder

Authored by Prashant Singh, Amit Kumar Sharma, Payal Sood, and Paramdeep Singh in 2015, this design features a remote controller that eliminates the need for manual settings. Users can adjust feed times, intervals, and quantities. The system includes features such as feed time alerts, refill notifications, a dual power supply with battery backup, and a message alert system if the pet is not fed. Sensors ensure leftover food is dispensed before new portions, making it a versatile and user-friendly feeder.

6. Digital Image Processing-A Quick Review

Authored by R. Ravikumar and Dr. V. Arulmozhi in 2019, this review highlights the significance of image processing in various applications. Image processing enables human-computer interaction by extracting complex features from images. Techniques and tools in this field help analyze single and multidimensional images, which is crucial for developing real-time applications.

7. Automatic Pet Feeder

Manoj M (2015) proposed a system where food is dispensed at regular, pre-programmed intervals using a microcontroller. The system includes two knobs to control feeding intervals and the duration the food outlet remains open. A DC motor operates the food outlet, and a buzzer indicates when food is dispensed. To prevent food from getting stuck, a vibrating DC motor is used. The system requires initial loading of food, resetting of the microcontroller, and selection of timing on the knobs to function properly.

Sl.No	Title	Author Name	Year	Description
1	Intelligent Food Dispenser (IFD)	Hari N. Khatavkar, Rahul S. Kini, Suyash K. Pandey, Vaibhav V.Gijare	2019	Controlled via an Android application and Wi-Fi module, this dispenser uses a microcontroller to operate a motor that dispenses food. It comprises a storage box with an opening and a lid moved by a DC motor. The Android app enables precise control over the dispensing duration. Image processing enhances real-time functionality.
2	Automatic Pet Feeder	Aasavari Kank, Anjali Jakhariye	2018	Employing sensors and an Arduino, this feeder detects pets' proximity and dispenses food into a bowl accordingly. A servo motor is used for locking. The system ensures efficient feeding whenever the pet approaches the feeder.
3	Pet Feeding Dispenser using Arduino and GSM Technology	Smruthi Kumar	2018	This system allows pet owners to remotely feed their pets via GSM technology. Upon receiving a text message, a solenoid valve and servo motor dispense food, with an option for water release. Confirmation messages are sent after feeding, catering to busy families' needs.

4	Automatic Pet Monitoring and Feeding System Using IoT	Automatic Pet Monitoring and Feeding System Using IoT	2017	Leveraging IoT, this system integrates sensors, RFID tags, and Arduino to monitor pets' activities and transmit data to cloud storage. Accessible via smartphones, it enables efficient pet monitoring and feeding, with potential for real-time clock integration for scheduling enhancements.
5	Remote Controlled and GSM Based Automated Pet Feeder	Prashant Singh, Amit Kumar Sharma, Payal Sood, Paramdeep Singh	2015	Featuring a remote controller, this feeder allows users to adjust feed times, quantities, and intervals. It includes various features such as feed time alerts, refill notifications, and a dual power supply with battery backup. Sensors ensure proper food dispensing, making it user-friendly and versatile.
6	Digital Image Processing - A Quick Review	R. Ravikumar, Dr. V. Arulmozhi	2019	This review emphasizes the importance of image processing in extracting complex features from images. It discusses various techniques and tools for real-time image analysis, highlighting its significance in human-computer interaction and multidimensional image processing applications.
7	Automatic Pet Feeder.	Manoj M	2015	Operated using a microcontroller, this feeder

				dispenses food at pre-programmed intervals. It includes knobs for timing adjustment and a DC motor-controlled food outlet. A buzzer indicates food dispensing, and a vibrating DC motor prevents food from getting stuck. The feeder requires initial loading and microcontroller reset for operation.

Table 1: Literature Review

CHAPTER 3
PROPOSED WORK

3.1 Block diagram

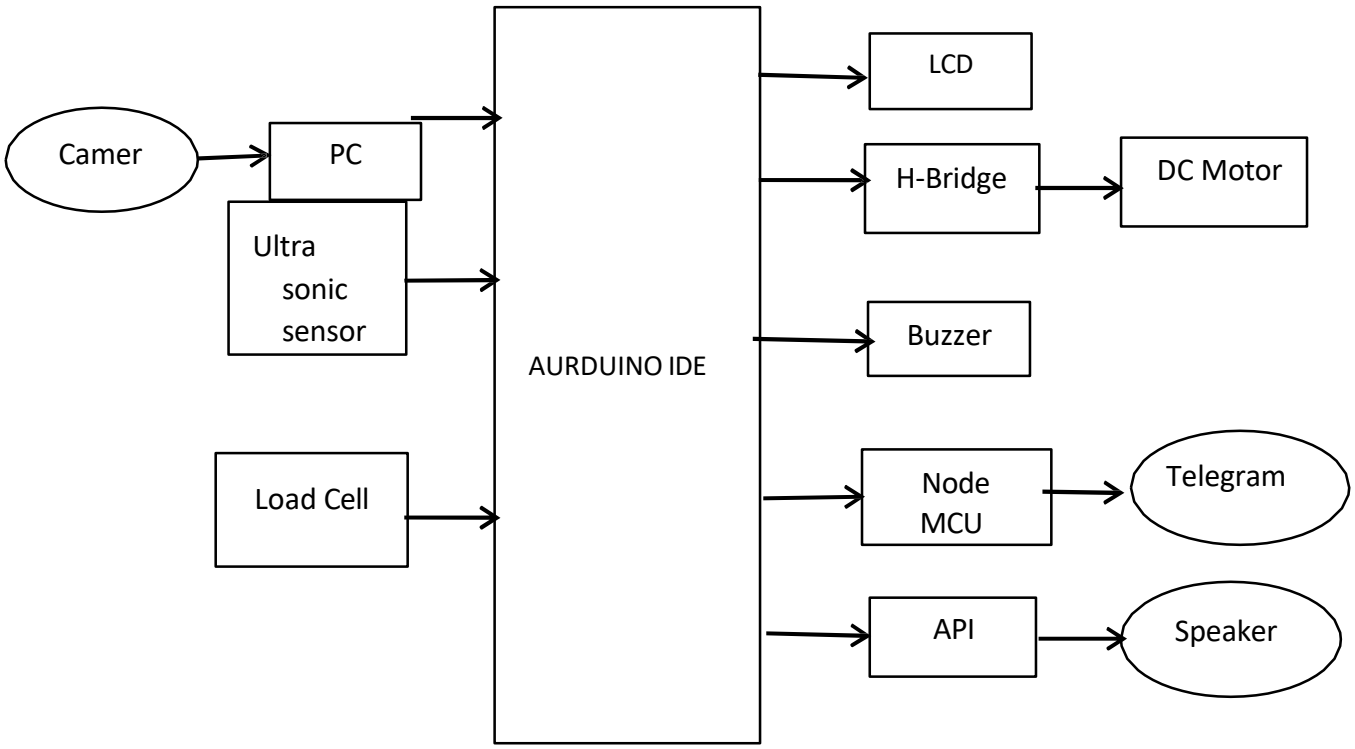


Fig 1: Block Diagram

Animal detection is a vital process that enables the recognition, localization, and detection of animals within images or videos. This can be achieved through various methods, including feature-based object detection, Viola-Jones object detection, SVM classifications with HOG features, and deep learning object detection. In our project, we propose a block diagram illustrating the implementation of animal detection. The Arduino IDE serves as the controller for our system, offering simplicity and cost-effectiveness in real-time applications.

Initially, a pet call is initiated using a recorded voice through a speaker, signaling feeding time for the pet. An ultrasonic sensor is deployed to detect the presence of the pet in front of the system. Once the pet is detected, a camera connected to a PC is activated to capture an image of the pet for processing. If the pet is recognized as the required pet, a DC motor is triggered to dispense food, with its rotation controlled by

an H-Bridge. The amount of food dispensed is regulated to meet the pet's dietary requirements by controlling the rotation of the DC motor.

Furthermore, a load cell is utilized to detect the presence of food in the bowl. When the food level decreases below a set threshold, the load cell triggers a message to be sent, indicating that the pet has been fed. This system is designed to accommodate multiple pets of various species, utilizing image processing techniques for detection and recognition. Convolutional Neural Network (CNN) is employed for pet detection and recognition, necessitating the creation of a dataset for model training. TensorFlow Object Detection API is utilized, requiring the dataset to be converted to the TF Record file format. TensorFlow, a free open-source software library for data flow, is integral to this process.

In summary, our project integrates various technologies and methodologies to create a robust and efficient automatic pet feeder system. From animal detection using ultrasonic sensors and cameras to food dispensing controlled by DC motors and load cell monitoring, our system ensures pets are fed timely and appropriately. Additionally, message notifications sent to the owner's mobile phone via Twilio API and Telegram provide real-time updates on feeding activities, enhancing the overall pet care experience.

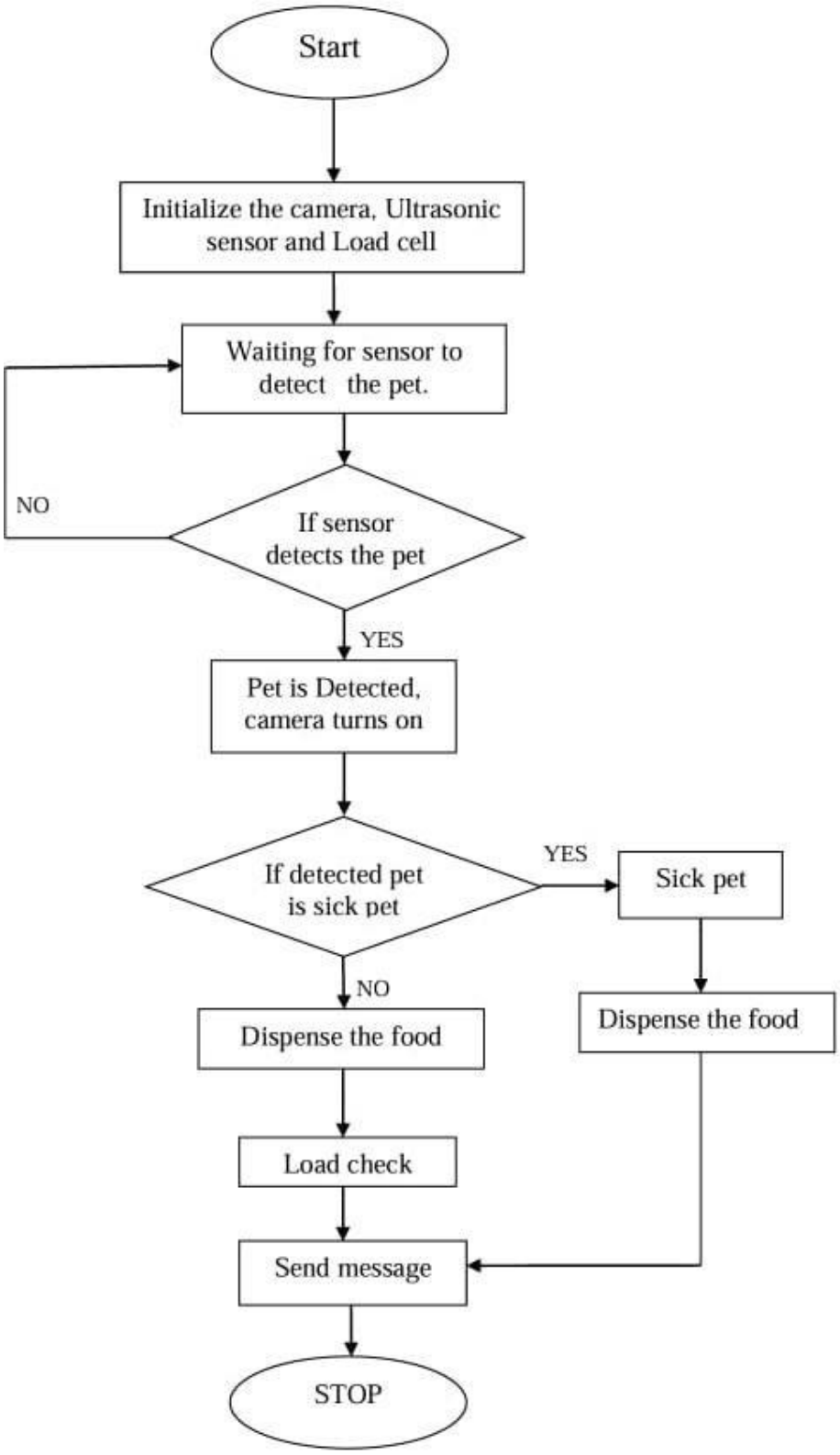
3.2 Flow of Data:

The flow of data in our automatic pet feeder system involves several key steps, each contributing to the efficient operation and monitoring of the feeding process. Below is an overview of the data flow within the system:

1. **Pet Call Initiation:** A recorded voice message indicating feeding time is played through a speaker, signaling to the pet that it's time to eat.
2. **Pet Presence Detection:** An ultrasonic sensor detects the presence of the pet in front of the feeding system, triggering the next steps.
3. **Image Capture and Processing**: Upon pet detection, a camera connected to a PC is switched on and captures an image of the pet. This image is then processed using convolutional neural network (CNN) techniques for pet detection and recognition.

4. **Recognition of Required Pet**: The processed image is analyzed to determine if the detected pet matches the required pet for feeding. If a match is found, the system proceeds to the next step.
5. **Food Dispensing:** A DC motor is activated to dispense the appropriate amount of food for the recognized pet. The rotation of the DC motor is controlled by an H-Bridge, ensuring precise food dispensing.
6. **Food Level Monitoring**: A load cell detects the presence of food in the bowl. If the food level decreases below a set threshold, it triggers a signal indicating that the pet has been fed.
7. **Notification**: Once the pet is successfully fed, a message is sent to the owner's mobile phone using the Twilio API, providing real-time updates on the feeding activity. Additionally, a message is sent to Telegram through a Node MCU for further notification.
8. **Data Logging and Storage:** Relevant data such as feeding times, pet recognition results, and food levels may be logged and stored for future reference or analysis. This data can help track feeding patterns and pet behavior over time.
9. **User Interaction:** The system may also include interfaces for user interaction, allowing pet owners to adjust feeding schedules, monitor pet activities, and receive notifications through a smartphone app or web interface.

Overall, this data flow ensures that pets are fed timely and appropriately, while providing pet owners with real-time updates and control over the feeding process, enhancing the overall pet care experience.


Start
Initialize the camera, Ultrasonic sensor and Load cell
Waiting for sensor to detect the pet.
NO
If sensor detects the pet
YES
Pet is Detected, camera turns on
If detected pet is sick pet
YES
Sick pet
NO
Dispense the food
Dispense the food
Load check
Send message
STOP

Flow of data

3.3 Hardware Requirements and Specifications

1) DC MOTOR

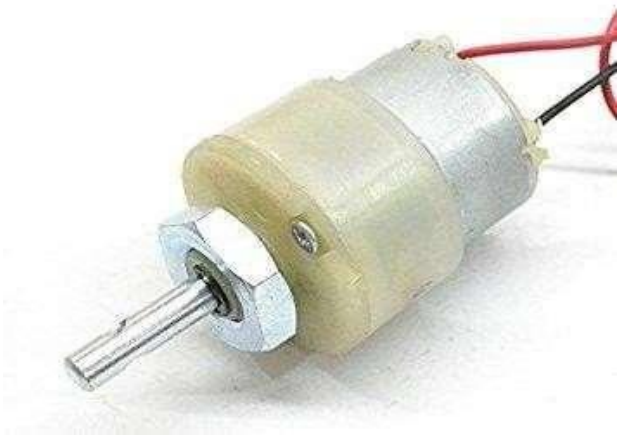


Fig 2: DC MOTOR

A DC motor is defined as a class of electrical motors that convert direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor. DC motors were the first form of motor widely used, as they could be powered from existing direct- current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. The DC motors are best suitable for the high speed applications. The DC motors are used in the application, where the continuous rotation is required. Such as, Remote controlled cars, fans, and vibrators. DC motors also offer their own advantages such as simpler installation and maintenance , high startup power and torque

,fast response times to starting, stopping, and acceleration and availability in several standard voltages. When designing the pet feeder, the manner in which the food would be dispensed along with how the food door will operate was in great debate.

DC motors also offer their own advantages, such as:

- Simpler installation and maintenance.
- High startup power and torque.
- Fast response times to starting, stopping, and acceleration.
- Availability in several standard voltages.

There are so many options to achieve these needs. Testing will need to be conducted to decide what style motor will be connected to the rubber paddle wheel that can be found in many commercial style manual dry food dispensers. It was decided that the best style motor for operating the food cover door, would be DC motor. Some features used when choosing the motors were size, torque, rotations per minute(RPM), accuracy, and use of application.

2) ULTRASONIC SENSOR

Fig 3: ULTRASONIC SENSOR

An ultrasonic sensor is an electronic device that uses ultrasonic sound waves above 20 kHz to detect the distance between a target item and converts the reflected sound into an electrical signal. Ultrasonic waves travel quicker than audible sound waves (i.e., the sound that humans can hear. Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. There are four pins that you would use to interface with the sensor: VCC, Trig (signal output pin), Echo (signal input pin), and GND. The more accurate ultrasonic sensors can achieve 0.1 – 0.2% of the detected range under perfectly controlled conditions, and most good ultrasonic sensors can generally achieve between 1% and 3% accuracy.

Product Features:

Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm.

The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work:

(1) Using IO trigger for at least 10us high level signal,

(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.

(3) IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.

Test distance = (high level time×velocity of sound (340M/S) / 2,

Wire connecting direct as following: 5V Supply, Trigger Pulse Input, Echo Pulse Output, 0V Ground, Electric Parameter, Working Voltage DC 5V, Working Current 15mA, Working Frequency 40Hz, Max Range 4m, Min Range 2cm, Measuring Angle 15 degree, Trigger Input Signal 10uS TTL pulse, Echo Output Signal Input TTL lever signal and the range in proportion Dimension 45*20*15mm

3) LOAD CELL

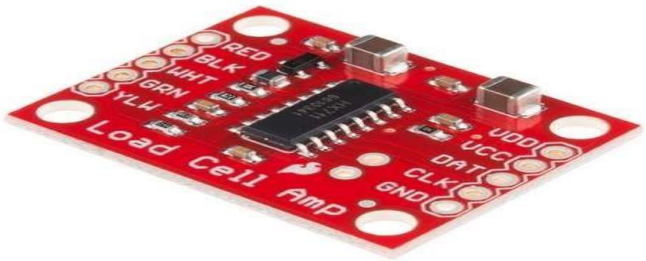


Fig 4: LOAD CELL

Load cells are sensors that detect force (mass, torque, etc.). When force is applied to a load cell, it converts the force into an electrical signal. Load cells are also known as "load transducers," because they convert a load (force) into electrical signals. A load cell is defined as a “weight measurement device necessary for electronic scales that display weights in digits”. The sensors that measure force include sensors that utilize springs or piezo films, pressure elements, displacement sensors, as well as a variety of other sensors. There are also a number of different load cells. These include magneto strictive load cells, capacitance load cells, gyro load cells, and strain-gauge load cells. Except for certain laboratories where precision mechanical balances are still used, strain gage load cells dominate the weighing industry.

Structurally, a load cell has a metal body to which strain gauges have been secured. The body is usually made of aluminum, alloy steel, or stainless steel which makes it very sturdy but also minimally elastic. This elasticity gives rise to the term "spring element", referring to the body of the load cell.

Pneumatic load cells are sometimes used where intrinsic safety and hygiene are desired, and hydraulic load cells are considered in remote locations, as they do not require a power supply. Strain gage load cells offer accuracies from within 0.03% to 0.25% full scale and are suitable for almost all industrial applications. Load cell designs can be distinguished according to the type of output signal generated (pneumatic, hydraulic, electric) or according to the way they detect weight (bending, shear, compression, tension, etc). Few advantages of load cell are:

- Load Cells have rugged & robust construction along with outstanding reliability and long term stability.
- They are specially designed to suit the harsh & severe industrial environment.
- Load Cells are temperature compensated.
- They have a stable system with no moving parts and linkages.

When classified by the direction of load detection, load cells can be divided into the following types: tension, compression, alternating, and bending. Based on precision, load cells can be classified as ultra precision, precision, standard, and general-purpose.

The HX711 load cell amplifier is used to get measurable data out from a load cell and strain gauge. This Hook up Guide will show you how to get started with this amplifier using some of the various load cells we carry at Spark Fun.

4) LCD

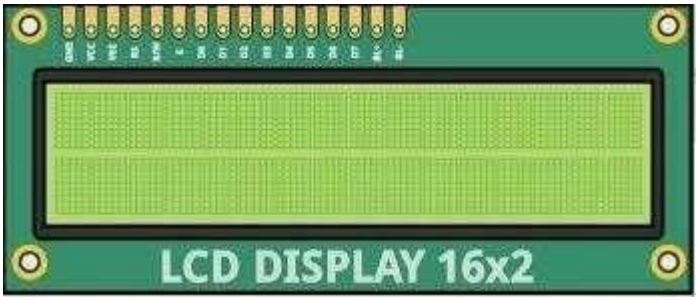


Fig 5: LCD

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low

information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays. They use the same basic technology, except that arbitrary images are made from a matrix of small pixels, while other displays have larger elements.

LCDs can either be normally on (positive) or off (negative), depending on the polarizer arrangement. For example, a character positive LCD with a backlight will have black lettering on a background that is the colour of the backlight, and a character negative LCD will have a black background with the letters being of the same colour as the backlight. Optical filters are added to write on blue LCDs to give them their characteristic appearance. Since LCD screen do not use phosphors, they rarely suffer image burn-in when a static image is displayed on a screen for a long time, e.g., the table frame for an airline flight schedule on an indoor sign. LCDs are, however, susceptible to image persistence.

The LCD screen is more energy-efficient and can be disposed of more safely than a CRT can. Its low electrical power consumption enables it to be used in battery-powered electronic equipment more efficiently than a CRT can be. By 2008, annual sales of televisions with LCD screens exceeded sales of CRT units worldwide, and the CRT became obsolete for most purposes. Advantages of Liquid-Crystal Displays (LCDs)

- Energy Efficient. LCDs are known for their energy-efficient properties.
- Long-Lasting. Another advantage of LCDs is their ability to last for a very long time.
- LED Backlighting.
- No Screen Burn-In.
- Supports Small and Low-Profile Sizes.

5) H-BRIDGE

Fig 6 : H-Bridge

A H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards. The name is derived from its common schematic diagram representation, with four switching elements configured as the branches of a letter "H" and the load connected as the cross-bar. H bridge is used to supply power to a two terminal device. By proper arrangement of the switches, the polarity of the power to the device can be changed. Two examples are discussed below, DC motor Driver and transformer of switching regulator. Note that, not all of the case of switching condition is safe. The "short"(see below in "DC motor driver" section) cases are dangerous to the power source and to the switch.

Features

• Can be used to run Two DC motors with the same IC.

• Speed and Direction control is possible

• Motor voltage Vcc2 (Vs): 4.5V to 36V

• Maximum Peak motor current: 1.2A

• Maximum Continuous Motor Current: 600mA

• Supply Voltage to Vcc1(vss): 4.5V to 7V

• Transition time: 300ns (at 5Vand 24V)

• Automatic Thermal shutdown is available

• Available in 16-pin DIP, TSSOP, SOIC packages

6) BUZZER

Fig 7 :Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications. There are two types are buzzers that are commonly available. The one shown here is a simpl e buzzer which when powered will make a Continuous Beeeeeeppp sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it. But, the one shown here is most widely used because it can be customised with help of other circuits to fit easily in our application.

This buzzer can be used by simply powering it using a DC power supply ranging from 4V to 9V. A simple 9V battery can also be used, but it is recommended to use a regulated +5V or +6V DC supply. The buzzer is normally associated with a switching circuit to turn ON or turn OFF the buzzer at required time and require interval.

Applications of Buzzer

- Alarming Circuits, where the user has to be alarmed about something
- Communication equipments
- Automobile electronics
- Portable equipments, due to its compact size

A buzzer or beeper is an audio signal device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. There are many ways to communicate between the user and a product. One of the best ways is audio communication using a buzzer IC. So during the design process, understanding some technologies with configurations is very

helpful. So, this article discusses an overview of an audio signal device like a beeper or a buzzer and its working with applications .An audio signa device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

The advantages of a buzzer include the following.

- Simply Compatible.
- Frequency Response is Good.
- Size is small.
- Energy Consumption is less.
- The Range of Voltage usage is Large.
- Sound Pressure is high.

7) POWER SUPPLY

Figure 8 : Power Supply

A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power. Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the

current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

8) Node MCU

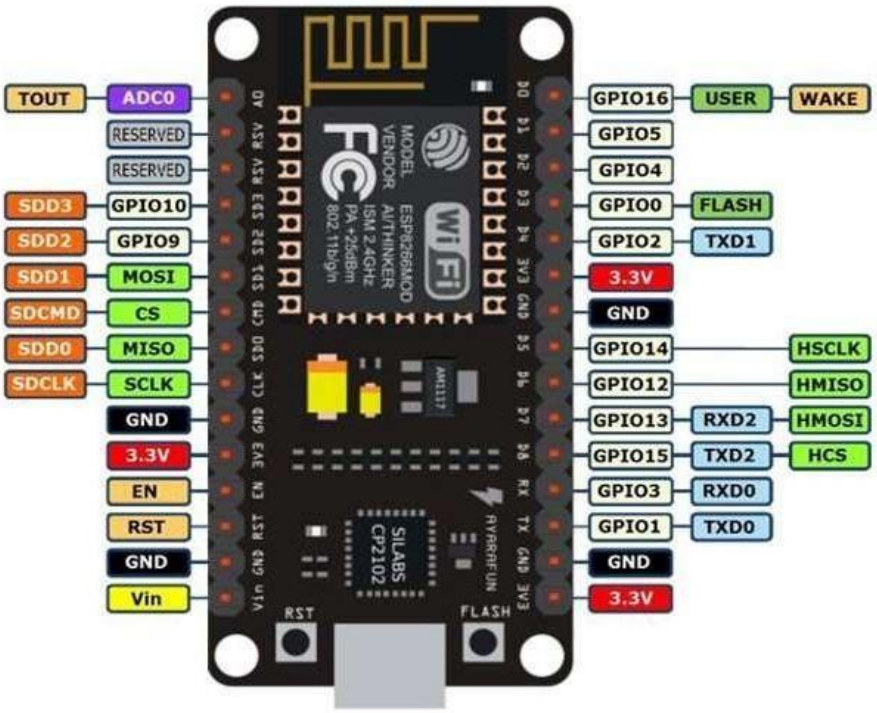


Figure 9:Node MCU

The NodeMCU ESP8266 microcontroller is a highly capable board powered by a Tensilica 32-bit RISC CPU Xtensa LX106. It operates at a voltage of 3.3V and can accept an input voltage ranging from 7 to 12V. The board features 16 digital input/output pins (DIO) and one analog input pin (ADC) capable of measuring analog voltage in the range of 0 to 3.3V. It has one Universal Asynchronous Receiver-Transmitter (UART), one Serial Peripheral Interface (SPI), and one Inter-Integrated Circuit (I2C), although the I2C functionality requires identification of specific pins due to their internal configuration.

Power can be supplied through the micro-USB port, the regulated 3.3V pin, the ground (GND) pins, or the external power supply pin (Vin). The board also includes control pins such as EN and RST, which reset the microcontroller. For SPI communication, the NodeMCU provides four pins: SD1, CMD, SD0, and CLK. It also supports UART

interfaces, with UART0 (RXD0 & TXD0) and UART1 (RXD1 & TXD1) being available, the latter of which is used to upload firmware or programs.

The microcontroller comes with 4 MB of flash memory, 64 KB of SRAM, and operates at a clock speed of 80 MHz. It also includes a USB-TTL converter based on the CP2102 chip, facilitating easy plug-and-play connectivity, and features a PCB antenna.

3.4 SOFTWARE REQUIREMENTS

Software Requirements is a field within software engineering that deals with establishing the needs of stakeholders that are to be solved by software. The IEEE Standard Glossary of Software Engineering. A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed document.

Some of the important Software requirements required in our project are:

Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform application for Windows, macOS, Linux that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards. The Arduino IDE supports the languages C and C++ using special rules of code structuring. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board. The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.

The Arduino Uno is one kind of microcontroller board based on ATmega328, and Uno is an Italian term which means one. Arduino Uno is named for marking the upcoming release of microcontroller board namely Arduino Uno Board 1.0. This board includes digital I/O pins- 14, a power jack, analog i/ps-6, ceramic resonator-A16 MHz, a USB connection, an RST button, and an ICSP header. All these can support the microcontroller for further operation by connecting this board to the computer. The power supply of this board can be done with the help of an AC to DC adapter, a USB

cable, otherwise a battery. This article discusses what is an Arduino Uno microcontroller, pin configuration, Arduino Uno specifications or features, and applications.

The ATmega328 is one kind of single-chip microcontroller formed with Atmel within the megaAVR family. The architecture of this Arduino Uno is a customized Harvard architecture with 8 bit RISC processor core. Other boards of Arduino Uno include Arduino Pro Mini, Arduino Nano, Arduino Due, Arduino Mega, and Arduino Leonardo.

The features of Arduino Uno ATmega328 includes the following.

- The operating voltage is 5V
- The recommended input voltage will range from 7v to 12V The input voltage ranges from 6v to 20V
- Digital input/output pins are 14 Analog i/p pins are 6
- DC Current for each input/output pin is 40 mA DC Current for 3.3V Pin is 50 mA
- Flash Memory is 32 KB SRAM is 2 KB EEPROM is 1 KB
- CLK Speed is 16 MHz

The Arduino Uno power supply can be done with the help of a USB cable or an external power supply. The external power supplies mainly include AC to DC adapter otherwise a battery. The adapter can be connected to the Arduino Uno by plugging into the power jack of the Arduino board. Similarly, the battery leads can be connected to the Vin pin and the GND pin of the POWER connector. The suggested voltage range will be 7 volts to 12 volts.

The Arduino Uno ATmega328 offers UART TTL-serial communication, and it is accessible on digital pins like TX (1) and RX (0). The software of an Arduino has a serial monitor that permits easy data. There are two LEDs on the board like RX & TX which will blink whenever data is being broadcasted through the USB.

Arduino Uno can detect the surroundings from the input. Here the input is a variety of sensors and these can affect its surroundings through controlling motors, lights, other actuators, etc. The ATmega328 microcontroller on the Arduino board can be programmed with the help of an Arduino programming language and the IDE

(Integrated Development Environment). Arduino projects can communicate by software while running on a PC.

Applications of Arduino Uno ATmega328

Arduino Uno is used in Do-it-Yourself projects prototyping. In developing projects based on code-based control Development of Automation System Designing of basic circuit designs.

Thus, this is all about Arduino Uno datasheet. From the above information finally, we can conclude that this is an 8-bit ATmega328P microcontroller. It has different components like serial communication, crystal oscillator, the voltage regulator for supporting the microcontroller. This board includes a USB connection, digital I/O pins-14, analog i/p pins-6, a power-barrel jack, a reset button, and an ICSP header.

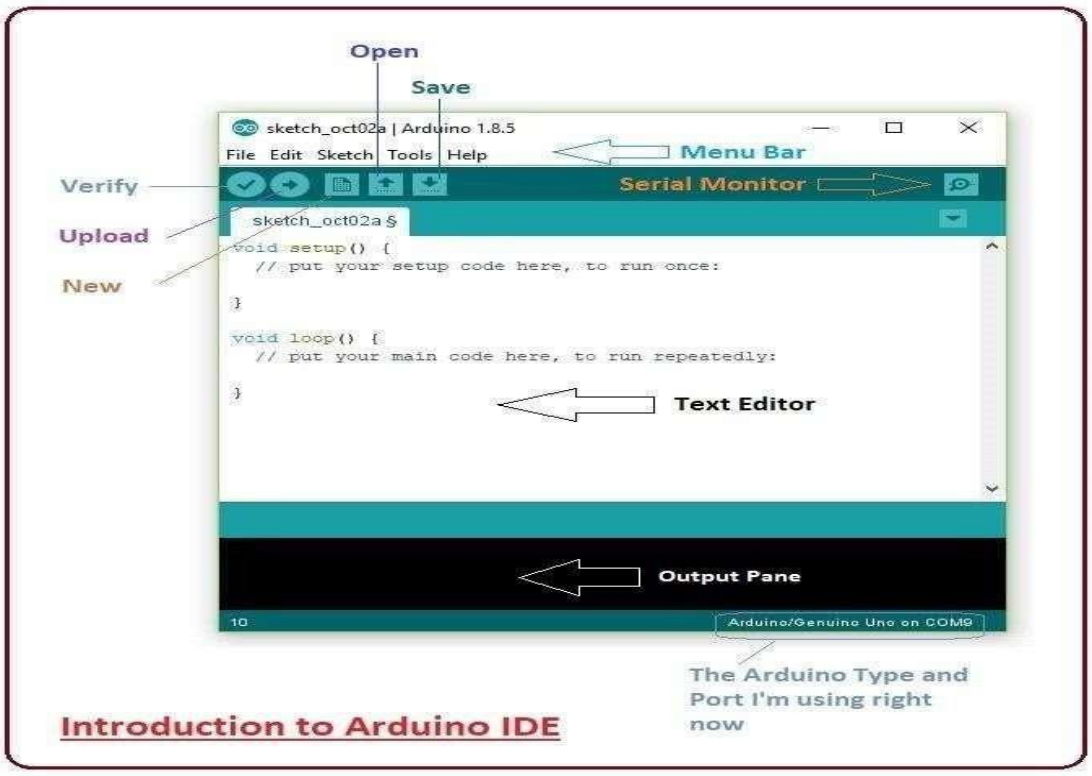


Fig 10:Arduino IDE

Embedded C

Embedded C is an extension to C programming language that provides support for developing efficient programs for embedded devices. It is not a part of the C language. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements.

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software.

Embedded C programming plays a key role in performing specific function by the processor. In day-to-day life we used many electronic devices such as mobile phone, washing machine, digital camera, etc. These all device working is based on microcontroller that are programmed by embedded C.

Arduino IDE (Integrated development Environment) is fully developed into functionality of full of libraries, as long as programming the Arduino UNO in Embedded C language is possible because Arduino IDE can compile both Arduino code as well as AVR standard code. When designing software for a smaller embedded system with the 8051, it is very common place to develop the entire product using assembly code. With many projects, this is a feasible approach since the amount of code that must be generated is typically less than 8 kilobytes and is relatively simple in nature. If a hardware engineer is tasked with designing both the hardware and the software, he or she will frequently be tempted to write the software in assembly language.

The trouble with projects done with assembly code can is that they can be difficult to read and maintain, especially if they are not well commented. Additionally, the amount of code reusable from a typical assembly language project is usually very low. Use of a higher-level language like C can directly address these issues. A program written in C is easier to read than an assembly program.

Since a C program possesses greater structure, it is easier to understand and maintain. Because of its modularity, a C program can better lend itself to reuse of code from project to project. The division of code into functions will force better structure of the software and lead to functions that can be taken from one project and used in another, thus reducing overall development time. A high order language such as C allows a developer to write code, which resembles a human's thought process more closely than does the equivalent assembly code. The developer can focus more time on designing the algorithms of the system rather than having to concentrate on their individual implementation. This will greatly reduce development time and lower debugging time since the code is more understandable.

By using a language like C, the programmer does not have to be intimately familiar with the architecture of the processor. This means that someone new to a given processor can get a project up and running quicker, since the internals and organization of the target processor do not have to be learned. Additionally, code developed in C will be more portable to other systems than code developed in assembly. Many target processors have C compilers available, which support ANSIC.

All of this is not to say that assembly language does not have its place. In fact, many embedded systems (particularly real time systems) have a combination of C and assembly code. For time critical operations, assembly code is frequently the only way to go. One of the great things about the C language is that it allows you to perform.

CHAPTER 4

RESULTS AND DISCUSSIONS

This design of pet feeder provides the features which will make pet care more convenient for both owner and the pet this system also provides all the information about the pet's feeding like is it taking feed or not, is it taking feed in proper quantity or not which help in get rid of over feeding problem. This design also helps in stopping wastage of feed by providing the left feed first. And as go for the advancement some of the features can be modified as using camera at place of sensor for priority feed of pet.

working process of the IoT-based automatic pet feeder:

1. **Ultrasonic Sensor Detects the Pet**

- The system initializes and the ultrasonic sensor is activated to detect the presence of a pet.

- If the sensor detects the pet, it proceeds to the next step.

2. LCD Shows "Pet Detected"

- The LCD screen displays the message "Pet Detected" to indicate that the ultrasonic sensor has detected a pet.

3. LCD Shows "Wait for Pet Identification"

- The LCD screen then updates to display the message "Wait for Pet Identification" while the system prepares to identify the specific pet.

4. Pet is Identified Through Image Processing

- The camera turns on and captures an image of the pet.

- Image processing techniques are applied to identify the pet based on pre-trained models.

5. Speaker Announces Which Pet is Detected

- Once the pet is identified, the speaker announces which pet has been detected. For example, it might say "Cat detected" or "Dog detected."

6. Detected Pet's Bowl Opens and Food is Dispensed

- The system activates the specific food bowl for the identified pet. The corresponding bowl opens and the DC motor activates to dispense the appropriate amount of food.

- The amount of food dispensed is controlled by the rotation of the DC motor, which is managed by an H-Bridge circuit.

CHAPTER 5

APPLICATIONS, ADVANTAGES AND CHALLENGES

5.1 Applications

1. **Pet Care**: Ideal for pet owners who need to ensure their pets are fed properly while they are away from home.

2. **Animal Shelters**: Useful in animal shelters to manage feeding schedules for multiple animals efficiently.

3. **Veterinary Clinics**: Can be employed in veterinary clinics to monitor and control the diet of animals under care.

4. **Research**: Beneficial for research purposes where the diet and feeding patterns of animals need to be controlled and monitored accurately.

5. **Smart Homes**: An addition to smart home systems, providing an automated solution for pet care integrated with other smart devices.

5.2 Advantages

1. Automation: The project automates the feeding process for pets, ensuring timely and accurate feeding without human intervention.

2. Remote Monitoring: The integration with Twilio API and Telegram allows pet owners to receive notifications and monitor the feeding process remotely.

3. Customized Feeding: The system can cater to multiple pets with different dietary needs, dispensing appropriate food portions using image recognition and DC motors.

4. Cost-Effective: Utilizing Arduino IDE and NodeMCU ESP8266 makes the system affordable and accessible for a wide range of users.

5. Energy Efficiency: Components like DC motors and LCDs are chosen for their low power consumption, making the system energy efficient.

6. Reliability: Load cells and ultrasonic sensors provide accurate detection of pet presence and food levels, ensuring the system's reliability.

5.3 Challenges

1. Image Recognition Accuracy: Ensuring high accuracy in pet detection and recognition using convolutional neural networks can be challenging, especially with varying lighting conditions and backgrounds.

2. Hardware Integration: Seamless integration of multiple hardware components like ultrasonic sensors, load cells, DC motors, and the microcontroller can be complex.

3. Internet Dependency: The system's reliance on internet connectivity for remote monitoring and notifications may pose a challenge in areas with poor internet service.

4.Power Supply: Ensuring a stable and continuous power supply to the system is crucial, especially in areas prone to power outages.

5. Calibration and Maintenance: Regular calibration of sensors and maintenance of mechanical parts like DC motors is necessary to ensure the system's accuracy and longevity.

6. User Training: Pet owners may need training to use the system effectively, particularly in setting up and troubleshooting the device.

7. Security: Ensuring the security of the system, particularly with respect to internet connectivity and remote access, to prevent unauthorized control or data breaches.

By addressing these challenges and leveraging the system's advantages, the project can significantly enhance pet care automation and management.

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

6.1 Conclusion

The animal detection and automated pet feeding system offers a comprehensive solution for ensuring pets are fed accurately and on time without constant human supervision. By leveraging technologies such as ultrasonic sensors, load cells, DC motors, and convolutional neural networks, the system can detect, recognize, and feed pets efficiently. The integration with Arduino IDE and NodeMCU ESP8266 provides a cost-effective and reliable platform for this application. Furthermore, remote monitoring through Twilio API and Telegram enhances the convenience for pet owners, making it easier to manage pet care from a distance. This system not only caters to single pets but also supports feeding multiple pets with different dietary requirements, highlighting its versatility and practicality.

6.2 Future Scope

- **Enhanced Image Recognition**: Improving the accuracy of pet detection and recognition through advanced deep learning models and larger, more diverse training datasets.
- **Mobile Application**: Developing a dedicated mobile application for easier control and monitoring of the system, providing a more user-friendly interface and additional features.
- **Voice Commands**: Integrating voice command capabilities using virtual assistants like Alexa or Google Assistant for more intuitive user interactions.
- **Battery Backup**: Implementing battery backup solutions to ensure continuous operation during power outages, enhancing the reliability of the system.
- **Scalability**: Designing the system to be easily scalable to accommodate more pets and larger feeding operations, such as in animal shelters or veterinary clinics.
- **Data Analytics**: Incorporating data analytics to track and analyze pet feeding patterns, health metrics, and behavioral trends, providing valuable insights to pet owners and veterinarians.
- **Multi-language Support**: Adding multi-language support for notifications and the user interface to cater to a broader audience.

- **Environment Adaptation**: Developing adaptive algorithms that can adjust feeding times and portions based on environmental factors such as temperature and pet activity levels.
- **Integration with Health Monitoring Devices**: Combining the feeding system with health monitoring devices like pet wearables to offer a holistic pet care solution.
- **Advanced Security Measures**: Enhancing the security features to protect against unauthorized access and ensure the privacy and safety of user data.

By exploring these future enhancements, the system can become more robust, user-friendly, and versatile, catering to the evolving needs of pet care and management.

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IOT BASED AUTOMATIC PET FEEDER

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Abstract: Facial A new design of pet feeder is proposed which can be controlled by interactive remote controller which helps to get rid of the manual settings of the previous versions of pet feeder. This design contains many new features as compared to the previous versions. In this design user can adjust the feed time, time gap between consecutive feeds and the quantity of feed served. This design also contains the call for pet at feed time, refill alert, dual power supply with battery charger, Massage alert system for owner in case of pet don't get it's feed, safety lock for container, sensor based system to serve previously served feed in case of left feed and the priority feeder with dual option of serve as by owner can opt for multi time and pet can opt for 1 time between feed time gap.

Keyword: Microcontroller, Image Processing, H-Bridge, Python, Sensor, Servo motors, Message.

I. INTRODUCTION

In the recent years, Nowadays, people tend to be busier and due to this beings tend to overlook additionally a number of their obligations which might be the primary purpose of trouble One of those obligations is having a puppy at home. Most humans need to have their personal pet for its appealing appearance, loyalty and playful personality. Having a puppy is a responsibility which doesn't go into waste because having a puppy serves enjoyment and employer at domestic One foremost trouble within the gift society is the people's busyness. It is one major reason why puppy proprietors devote irresponsible deeds with regards to looking after their pets. Their pets appear to be on the bottom listing of their priorities. One important factor on puppy care is feeding. This is in which this challenge is available in movement in which a Digital Image Processing primarily based food dispenser will be activated on pet detection and recognition. The motive of our mission is to offer a simpler and extra efficient way for the pet owners to feed their pets, even when they may be now not at domestic and when they are no longer capable of manipulate remotely. Specifically, the purpose is to construct a design which can automatically discover specific pets, healthy the detected pets with the modern stored pet profiles and dispense the right sort of meals at the person precise quantity. A critical point is that the pet feeder can help pets from distinct species. The meals boxes and food plates are all separate in order that the person can put distinctive ingredients for distinctive pets. Man-made has been seeing a grand development in overcoming any issues between the capacities of people and machines. Specialists and fans the same, chip away at various parts of the field to cause astonishing things to occur. One of numerous such regions is the space of Computer Vision. The motivation for this field is to empower machines to see the world as people do, see it likewise and even utilize the information for a huge number of assignments, for example, Image and Video acknowledgment, Image Analysis and Classification, Media Recreation, Recommendation Systems, Natural Language Processing, and so on. The progressions in Computer Vision with Deep Learning has been developed and idealized with time, fundamentally more than one specific calculation a Convolutional Neural Network.

II. METHODOLOGY

Animal Detection is the process of finding real-world animals in still images or Videos. It allows for the recognition, localization, and detection of animals within an image. Animal Detection can be done via multiple ways: Feature- Based Object Detection, Viola Jones Object Detection, SVM Classifications with HOG Features and Deep Learning Object Detection. The Above diagram illustrates the proposed block diagram we are implementing in the project. The Arduino IDE is the controller we are employing in the system. The Arduino IDE is a basic embedded system and being a low-cost single board computer used to reduce the complexity of systems in real time applications we have used the board. At First, In the project a pet call is provided using a recorded voice through a speaker to indicate feed time of the pet is initiated. The Ultrasonic Sensor is placed in order to detect the pet in front of the system. Once the pet detection is done using an ultrasonic sensor, the camera which is connected to PC is switched on and Camera captures image of the pet and processes. If the pet is recognized as required pet, a dc motor will be activated to dispense food. The dc motor is rotated to serve food and the rotation is controlled by H-Bridge. The diet of pet can be controlled by

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dispensing a proper amount of food. This is done by controlling the rotation of dc motor. And then loadcell is used to detect the presence of food in the bowl. Also, when the food starts to decrease than the set point value, the load cell detects and a message will be sent as pet is fed. This System is implemented to feed one pet or more than one pet of either same species or different species using Image processing. The project implemented is for pets of different species. Hence, we have employed dc motors to dispense different kinds of food for different pets. So, food containers and food bowls are provided in this design. Once the required pet if fed successfully, the message will be sent to the owner's mobile number using a Twilio API and the message sent to telegram through node MCU. Pets Detection and recognition is done using Convolution Neural Network technique. For model training first we need create dataset. TensorFlow Object Detection API uses the TF Record file format, so at the end we need to convert our dataset to this file format. TensorFlow is a free open source software library for data flow. To prepare the input file for the API you need to consider two things.

1) Image must be in the form of jpeg or png.
2) we need a list of bounding boxes for image and class of the object in the bounding boxes.

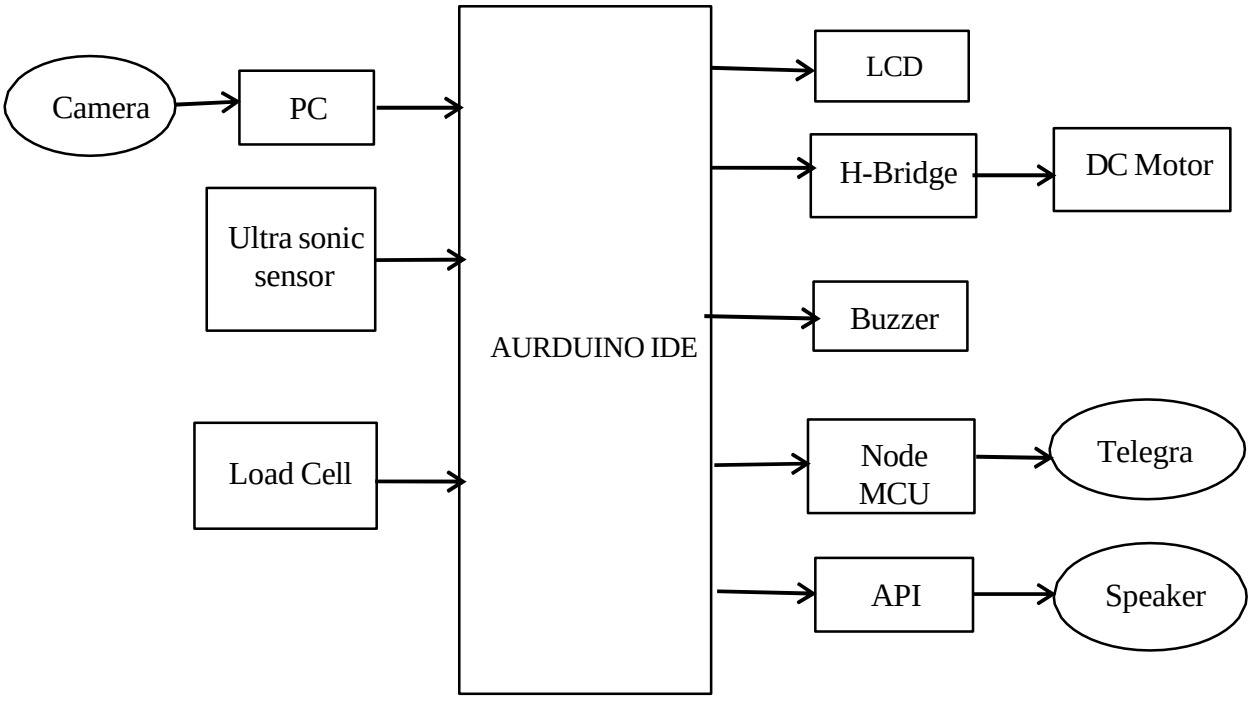

Figure 1: Block diagram of IOT Based Automatic Pet Feeder.

III. FLOWCHART

The flowchart begins with the initialization of the system, which includes setting up the camera, ultrasonic sensor, and load cell. The system then waits for the ultrasonic sensor to detect a pet. Once a pet is detected, the camera turns on to visually monitor the pet. Next, the system checks if the detected pet is required pet or sick pet. If the pet is identified as correct pet then machine start to dispense the respective pets food, If the pet is identified as sick, then food dispensed based on owner's settings and specific actions are taken before moving forward. After dispensing the food, a load check is performed to ensure there is enough food supply. Following this, the system sends a message to notify relevant parties about the food load status or any other important information. Finally, the process concludes with the system stopping, marking the end of the sequence. This flowchart outlines a pet monitoring and feeding system that uses sensors and cameras for detection, health evaluation, food dispensing, and notifications.

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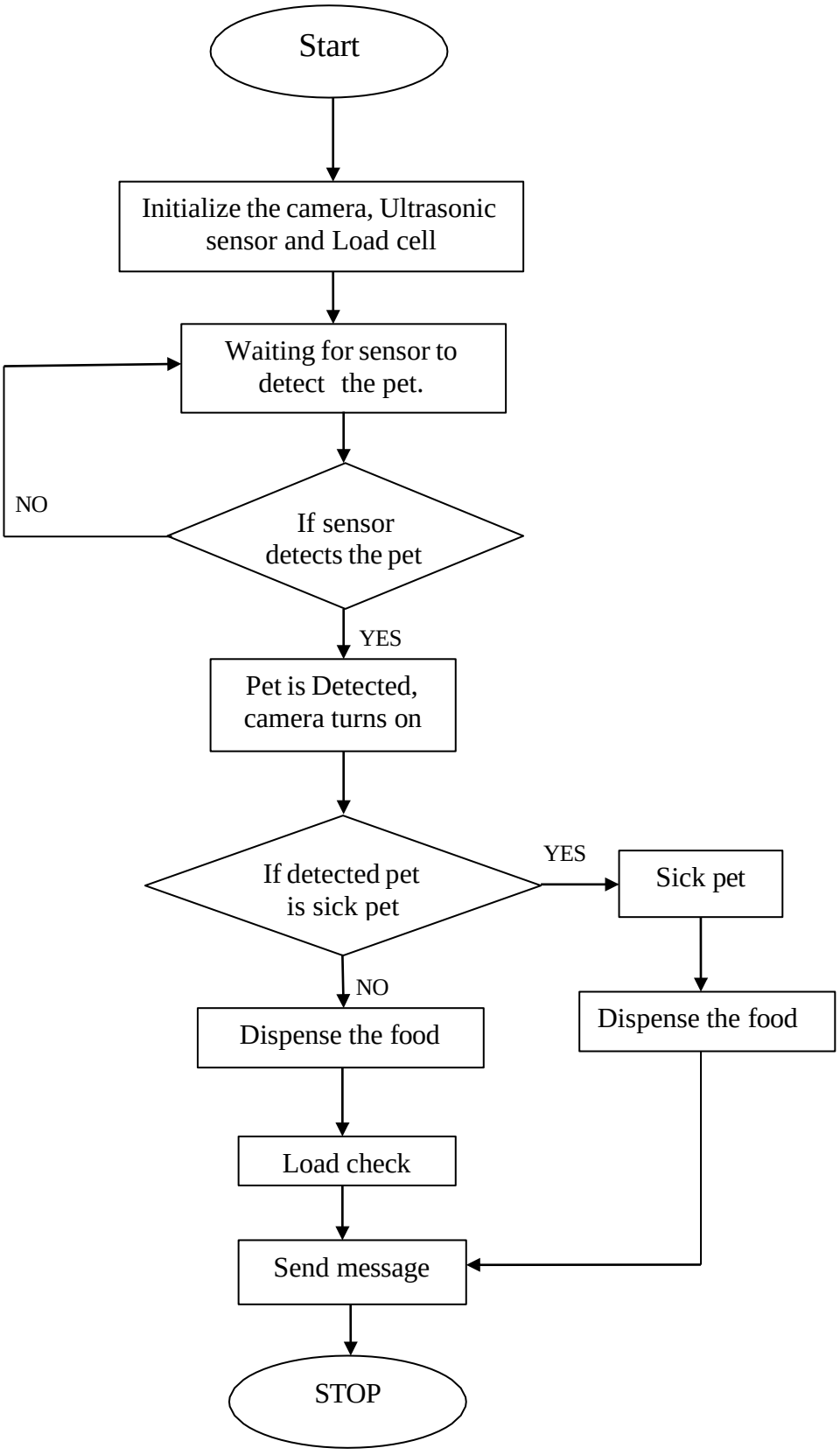

Figure 2: Flow chart of IOT Based Automatic Pet Feeder.

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IV. RESULT ANALYSIS

The IoT-based automatic pet feeder project introduces a highly advanced and user-friendly system for pet care, addressing the challenges of busy or frequently traveling pet owners. This innovative feeder can be controlled via an interactive remote controller, allowing users to set feed times, intervals between feeds, and the quantity of food dispensed, eliminating the need for manual adjustments seen in previous versions. Key features include a voice call function that uses the owner's recorded voice to summon pets at feeding times, ensuring they come to eat. The feeder also provides refill alerts when the food container is running low, and it includes a dual power supply with a battery charger for uninterrupted operation. A safety lock on the food container prevents unauthorized access, and sensors ensure that any uneaten food is dispensed first, minimizing waste.

The system operates in two modes: Smart Mode and Control Mode. In Smart Mode, it calculates the right amount of food based on the pet's weight and dietary requirements, ensuring proper nutrition. Control Mode allows for both scheduled automatic feeding and manual feeding at any desired time, with adjustable dispensing durations. Real-time measurements from the load cell and ultrasonic sensor guarantee accurate food dispensing. Additionally, a messaging alert system notifies owners if their pet misses a meal, providing peace of mind. This design not only improves the convenience and flexibility of pet feeding but also enhances monitoring capabilities, ensuring pets are properly fed and cared for even when their owners are not at home. Future enhancements could include integrating a camera for video monitoring and multimedia messaging, further increasing the system's interactivity and functionality.

V. CONCLUSION

The IoT-based automatic pet feeder represents a significant advancement in pet care technology, offering unparalleled convenience, flexibility, and food monitoring capabilities for pet owners. By integrating an interactive remote controller, the feeder allows precise customization of feed times, intervals, and quantities. Key features such as refill alerts, dual power supply, and safety lock enhance the system's functionality and reliability. The weight-based feeding and Control Mode for both scheduled and manual feeding ensure that pets receive the appropriate amount of food at the right times. Real-time measurements and a messaging alert system provide accurate dispensing and timely notifications, ensuring pet owners are always informed about their pets' feeding status. This innovative design not only helps maintain pet's health by preventing overfeeding and food wastage but also provides peace of mind for owners, knowing their pets are well cared for even in their absence. Future enhancements, such as integrating a camera for video monitoring, will further elevate the system's capabilities, making it an indispensable tool for modern pet care.

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