Smart Pet Feeder Using IoT

Patoliya Shyam, Peeyush Kumar, Pranshu Gupta, Ritam Mishra, Dr. Rupali Gangarde

Department of Computer Science and Engineering, Symbiosis Institute of Technology, Symbiosis International University (SIU), Pune, India

***Abstract* – Since almost every present device is upgrading with smart technology, the pets also cannot be far behind. In a nutshell, this project discusses the design and implementation of a smart IoT pet feeder device which is controlled by Google Assistant. The whole system consists of an ESP8266 microcontroller, a servo motor to dispense the food quantity, and a 16x2 LCD display for the human-human interaction (H2H interface). The systems feature's remotely feed the pet from anywhere across the globe by just saying "Ok Google, feed my pet" and feeding times can be set by saying "Feed my pet today morning" using Google Assistant commands which automatically scheduled the feeding times. Moreover, the IoT-based PFS enables the owners to remotely feed their pets, and simultaneously monitor in real time feeding time and food status of their pets. Taking advantage of the sensors such as weight sensor or infrared sensor, the system alerts the owner with low food level alarm or feeding failure alarm to prevent the pet from starvation. Furthermore, on account of its ability to trigger commands through Google Assistant, the system can be integrated into smart-home ecosystems, seamlessly embedded into existing daily routines that would include pet care in the regular course of events. When it comes to design, the project features an intuitive voice-command system backed up by an LCD display that provides a clear view of its status. Overall, the user experience has been conceived to become as easy as possible to avoid raising barriers to adoption, designed to facilitate engagement by non-expert users.**

***Keywords* - IoT, Google Assistant, NodeMCU ESP8266, remote feeding, automated schedules, servo motor, cloud control.**

I. INTRODUCTION

In today's society, our pets are interwoven into their owner's lives, much like how they were centuries ago throughout history. Our pets act as our family, since they add tenderness, smiles and unanimous affection towards their owners. At a time when the pace of modern life goes into overdrive, and work, travel, or other life commitments take priority, feeding our pets on time in a reliable manner poses a big challenge. If they cannot eat or simply skip their meals, that is a problem that directly affects their well-being and happiness. But what if we were to suggest that the might of IoT technology can resolve pet feeding issues and help owners maintain tight control over when and how much food their pets get and when they eat it? Enter the IoT pet feeder, a device specifically designed for this purpose. This new generation of connected pet feeders uses IoT technology to optimize feeding protocols, eliminate human error and unpredictability, and help pet owners give their pets food at just the right moment every day.

The need for the development of IoT pet feeders can be said to be a multi-faceted need rooted in a holistic commitment to improving the lives of pets and their owners. Historical approaches to feeding pets, such as the manual feeding as well as the static timed feeding approach, usually falls short of achieving this most useful goal of improving the lives of pets and their owners. The manual method of feeding pets is ill-suited to solve contemporary problems as it depends on the physical presence of the owner. It often fails when shown the cracks of time. The timed approach seldom caters to nuanced needs and tends to cramp a lot of pets as there is little or no room for customizing the unique feeding demand of pets. Unquestionably, historical use of pet feeding approach falls short of fully meeting the modern needs — hence, while considering the primary needs in order to fully address the elephant in the room, it is important to truly understand why IoT pet feeders are needed at this time. Despite the relentless cracks in the conventional approach to feeding pets, with IoT, the paradigm shift has taken a whole new coat. IoT pet feeders forms a perfect, non-intrusive and flexible human pet relationship. It is a truly game-changing approach to feeding pets as it fully balances the needs in the modern era and seamlessly finds a home within the new trend in form. Whereas pet owners once had to take their pets to the vet or rely on somewhat variable drugstore formulas to regulate their appetite, today's most medically aware pet owners can use anything from intuitive smartphone apps to voice-activated assistants to web-based interfaces to control exactly what food their pet put consumes every day, so that it will get exactly the nutrients it needs.

The quests this paper undertake are, first of all, a comprehending the essence and technology behind the development of IoT pet feeders; secondly, an invention of a top-end IoT pet feeder system, and also an evaluation of the influence of it on pet care actions and the human-animal relationship. Through a systematic cross-reference of the previous study cases and technological models, this paper would heal the rift between literature and technology. Through a systemic probing into the influence of IoT pet feeder on pet care actions and the human-animal relationship. Besides, we will put forth an evaluation of past deployment and current application of IoT feeders, analyzing user feedback, usage habits and behavioral record, presenting a flexible view upon the usability and acceptance of IoT pets. As for the practical function of the IoT pet feeder, this paper will dissect its influence on pet-caring habits, and how the development of these cutting-edge tech feeders would affect the having experience or the human-animal emotions. As for the future outlook of this technology, we would explore possible extensions and improvements regarding the functioning of IoT feeders, from uncovering further IoT feeding algorithms to the opening with cross-field technology, such as artificial intelligence and machine learning.

In short, with the development of IoT pet feeders, a brand-new chapter for pet-care would be unfolded. As for the human-pets relationship, people now not only able to take care of their animals in a more harmonized way, but they also empowered and provided more compassionate treatment.

II. Literature Survey

IoT-based pet care solutions have thrived, especially automated feeders, and the interest in this topic, mirroring the general intrusion of modern technology, has been growing steadily in recent years. A literature review shows us a series of elegant and interesting studies and projects that have contributed to the evolution of this domain. One of these studies, by Wang et al. (2018), designed and implemented a smart pet feeder on the IoT based on Raspberry Pi and Arduino platforms, in which the owners could remotely monitor the pet feeding, and feed the pets whenever they want using a dedicated mobile app, which demonstrate the feasibility and the benefits of IoT technology in pet feeding management. Likewise, Lee et al (2019) also provided a smart pet feeder system with facial recognition features that allows certain pets to be automatically fed based on their unique features. The inclusion of facial recognition helped to not only better personalize the feeding process, but also secured the system, improving the user experience overall.

Furthermore, most of the pet feeder system that we mentioned before are not just standalone product, IoT technology was even studied and implemented into the common ecosystem of smart home products. The study of Li et al. (2020) provided an example of an IoT-based control for an integrated smart home system that include temperature control, camera surveillance monitoring and pet food dispensing. Li's research demonstrated the possibility of IoT elevating the overall home life and also a new era of home care. Furthermore, research has revealed that voice-controlled assistants such as Amazon Alexa and Google Assistant can be utilized in pet care applications. For instance, Kim et al. (2019) designed a voice-controlled pet feeder system using Amazon Alexa for command understanding and execution. A survey of the literature indicates an increase in interest for IoT-based solutions for pet care. Researchers have studied a broad range of available hardware setups, software architectures, and integration mechanisms in order to optimize pet feeding automation and enhance user experience. We are extending our foundational work to develop a voice-controlled IoT pet feeder which will be controlled by Google assistant. Using the power of voice control, mobile friendly accessibility and low-cost material, this project aims to make its position in this eager pet-care automation market, convenient the life for pet owners.

Moreover, building upon the wisdom of prior research, this project endeavors to improve current techniques and extend the boundaries of IoT pet care innovation. Through careful specification, thorough testing, and cyclic enhancement, the envisaged IoT pet feeder envisions to not simply meet but surpass the expectations of pet owners, fueling the dawn of a new generation of smarter, more responsive pet care solutions. Moreover, as the field of IoT pet care matures, it is pertinent to ponder the ethical and privacy considerations that come with the acquisition and utilization of pet-specific data. Striking a balance between novelty and propriety is crucial for the ethical development and deployment of IoT pet care solutions. Furthermore, continued research into user experience, human-animal interaction, and behavioral psychology can illuminate the design of user-friendly interfaces that offer a universal appeal to pet owners of various tastes and cultural backgrounds. In conclusion, the development of IoT-based pet care solutions represents a marriage of technological innovation, tender loving care, and ardent respect for the human-animal bond. By leveraging the power of IoT, artificial intelligence, and digital networking, these breakthroughs have the potential to redefine pet care paradigms by enhancing the health, happiness, and mutual satisfaction of pets and their humans.

III. Design Methodology

Final design methodology for IoT pet feeder controlled by Google Assistant using NodeMCU ESP8266 contains some major steps suggested to follow in order to create the necessary IoT system for the pet feeder. The suggested methodology aims to provide important considerations regarding the hardware components, the software components, and the usability of using the system including the user input.

1. Requirement Analysis:Design begins by establishing the requirements of the pet feeder system. This involves setting specifications for the functions, features and

performance objectives of the system, as well as its users' preferences.

- Hardware Selection: Through the requirements analysis, proper hardware pieces are chosen for IoT pet feeder system: NodeMCU ESP8266 microcontroller (Fig 1) for IoT connectivity. The NodeMCU ESP8266, acts as the central microcontroller for the IoT Pet Feeder. Servo motor (Fig2) for food-dispensing. Regulates the feeding bottle or trap door, enabling the food to be dispensed or the passage to be opened. 16x2 LCD modules with I2c modules (Fig 3) for feedback display visual. This provides a visual interface for users to monitor the status of the pet feeder.

Fig. 1. NodeMCU ESP8266

Fig. 2. Servo Motor

Fig. 3. 16 x 2 LCD

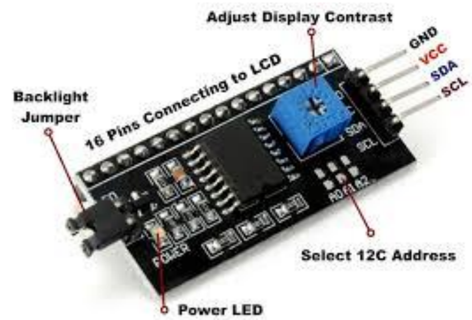

Fig. 4. I2c module

2. Circuit Design: The circuit Diagram is designed to depict how the selected hardware components are connected and interfaced with each other Such as connecting sever motor, LCD display and all the peripheral as per their pins as shown in fig.5.

   i. The Vin and GND pins of the servo motor and LCD module are connected to the Vcc and GND pins of the NodeMCU ESP8266, respectively, to supply power.

   ii. The SCL and SDA pins of the LCD module are linked to the D1 and D2 pins of the NodeMCU ESP8266 for communication if the I2C interface is applied.

   iii. The servo motor controller is connected to a digital pin of the NodeMCU ESP8266.

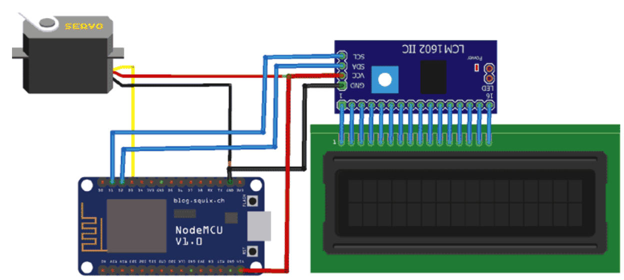

Fig. 5. Circuit diagram

3. Software Development: The software development stage consists of writing code to control the various hardware components and implement the functionality of the pet feeder system. This includes programming the NodeMCU ESP8266 Microcontroller unit to be able to communicate with Google Assistant via Adafruit IO, handle the movements of the servo motor to dispense the food, and display notifications / user interactions on the LCD display.

4. Integration with Google Assistant: Adafruit IO and IFTTT are utilised to prepare the pet feeder system to be integrated with Google Assistant for voice commands, as shown in Fig. 6. The communication channels between the NodeMCU ESP8266 micro-controller and Adafruit IO are established, and some custom applets are created on IFTTT to make the pet feeder respond to a voice

command by providing a pellet every time Google Assistant carries out the say' or tell' action.

5. Testing and Validation: Finally, we use testing and validation to determine if the pet feeder system is operating correctly and responds as expected within the limits of a given set of requirements and constraints. This involves tests for reliability, accuracy, ease of use and other requirements, as well as field trials to determine how the pet feeder system performs under certain environmental conditions.

Thus, if we stick to this design methodology, we will eventually and persistently create a systematic and formalised Google Assistant-controlled IoT pet feeder system, which will exactly cover the pet owners' needs in feeding pet with convenience and reliability.

IV. SYSTEM ARCHITECTURE

The line diagram illustrates the system architecture which is comprised of different components that are interconnected between hardware, software, communication protocols and dataflow.

Hardware Components:

1. **NodeMCU ESP8266 microcontroller**
2. **Servo motor**
3. **16x2 LCD display with I2C module**

Communication Protocols:

MQTT (Message Queuing Telemetry Transport): a light-weight messaging system that is used by the NodeMCU ESP8266 to communicate in real-time, and through the Adafruit IO platform, operate and control the esp8266 from anywhere.

HTTP/HTTPS: This allows Adafruit IO to communicate with IFTTT in order to generate trigger-based applets to deliver feeding events based on your Google Assistant voice commands.

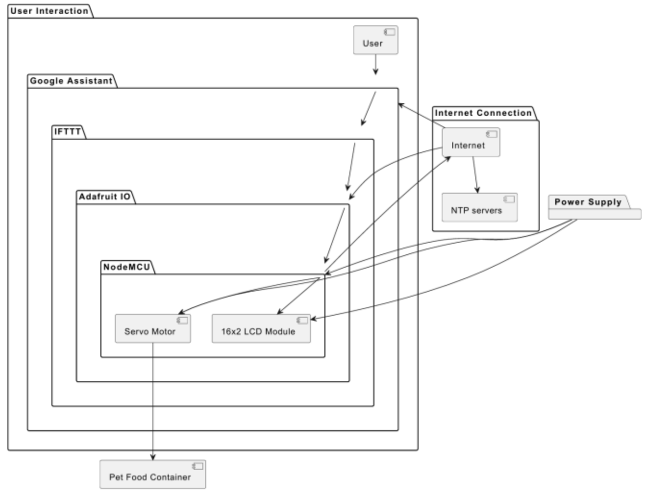

Fig. 6. System Architecture

System Flow:

User issues voice command to Google Assistant to feed the pet.

Google Assistant forwards the command to Adafruit IO via MQTT.

If that command is 'YES', then Adafruit IO triggers the proper applet on the IFTTT platform.

When the IFTTT platform provides the webhook request to dispense food, the NodeMCU ESP8266 receives the request.

The NodeMCU ESP8266 receives the webhook and sends the signal to turn on the servo motor which dispenses food in the specified quantity. Fig 7. The node MCU ESP8266 board and servo motor.

The LCD display provides visual feedback to the user about the feeding process.

The IFTTT platform sends a webhook request to the NodeMCU ESP8266, indicating the need to dispense food.

The NodeMCU ESP8266 receives the webhook request and activates the servo motor to dispense the specified amount of food, refer Fig. 7.

The LCD display provides visual feedback to the user about the feeding process.

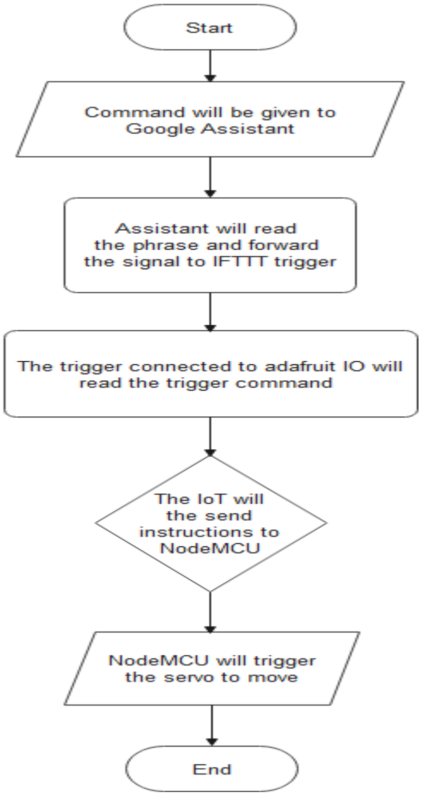

Fig. 7. System Flow

Data Flow and Storage:

Data related to feeding schedules, pet activity, and system status can be stored locally on the NodeMCU ESP8266 or remotely on cloud platforms such as Adafruit IO for long-term storage and analysis.

Data may also be transmitted to companion mobile applications for real-time monitoring and analysis by pet owners.

Security Considerations:

Encryption and authentication mechanisms should be implemented to secure communication channels between the NodeMCU ESP8266, Adafruit IO, and the IFTTT platform.

Access controls and user authentication methods should be employed to prevent unauthorized access to the pet feeder system and user data.

V. RESULT

The summary report for Google Assistant controlled smart pet feeder using NodeMCU ESP8266 is as follow.

1. Functionality: The pet feeder system successfully realize the remote pet feeding functionality by just the commands of us who control Google Assistant. We can get the pet food dispensed by the servo-controlled pet feeder from the IoT pet feeder system just to tell the system “Okay Google, feed my pet”.

2. Automation: The agent helps me in the task of pet feeding by providing an option for creating a schedule for feeding pets. The agents allow users to ask for schedule creation for feeding in morning, afternoon and evening. human: Please create a schedule for me for feeding my pets in the morning afternoon and evening. agent: During your feeding pets in the morning-10:00, afternoon- 15:06 and evening-19:00 agent: Thanks for submitting the request! It takes some time to automatically feed your pet. In10:00 agent: Agent automatically gives food to your pets without any physical interaction with you

3. Integration: The IoT pet feeder system is integrated correctly with Google Assistant, Adafruit IO and IFTTT. The system uses Adafruit IO and the custom applets of IFTTT to communicate from the NodeMCU ESP8266 to Google Assistant and register feeding events by voice commands.

4. Reliability: When it works, this system delivers the food to the pet as per the schedules set via the web application and parses the commands from the Google Assistant correctly, and the servo controlled feeder channels the feed from the container and over to the feeding tray without getting stuck anywhere on its way.

5. (Overall User Experience): Users have also increased their user experience by giving the feedback for the pet feeder. They feel the IoT pet feeder is intuitive, easy to use and its very useful specially in house owners absence. The voice command integration with the Google external system uplifts user interaction by providing the handsfree and easy user interaction.

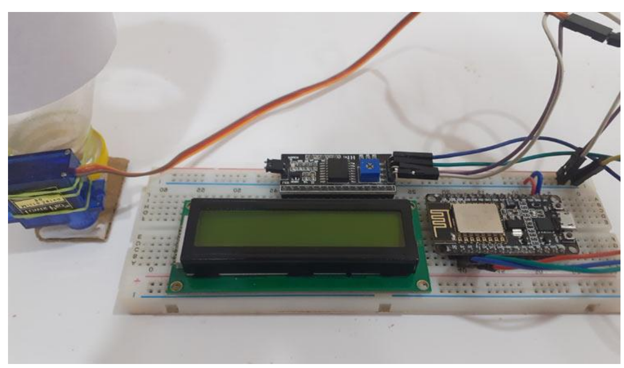

Fig. 8. Actual Hardware model

Overall, the results demonstrate the successful implementation of a Google Assistant-controlled IoT pet feeder using NodeMCU ESP8266, providing pet owners with a reliable and convenient solution for automated pet feeding.

VI. Conclusion and Future Scope

In conclusion, the IoT pet feeder controlled by the Google Assistant through the ESP8266 NodeMCU is an innovative technology that will change how pets are taken care of. Such a system solves the problem of ensuring that pets are fed properly when their protagonists are not in the house. With the IOT connection and voice control measure, pet owners can efficiently utilize the system for their comfort, convenience, and ease of mind. The pet feeder system integrates Google Assistant, Adafruit IO and IFTTT platform for communicating and interacting to allow the pet owners to feed their pets via voice command hence from any place. Other critical automation of the feeding system is feeding times which are pre-scheduled hence ensuring pets have food at the right time of the day.

Future Scopes:

Enhanced monitoring provide sensors for tracking pet actions, food quantities, and environmental state of the menu, monitoring and reporting in real-time to the pet owners.

Customisation alternative to provide multiple feeding schedules, portion sizes, and food types to be able to meet the diverse needs of different pet owners and their pets.

Health monitoring capabilities which allow the user to track pet health indicators like weight, the level of physical activity, and eating patterns, providing trusted recommendations for the pet care management. Smartphone integration an operating system designed mobile apps for iOS and Android which runs on both smartphones and tablets to provide additional controls and monitoring opportunities directly on smartphones and tablets. Machine learning –pet behavior data, which will be used to gain insight into feeding preferences.

7.References

1. J. Wang, H. Zhang, and Q. Li, "Design and Implementation of an IoT-Based Smart Pet Feeder," in IEEE Internet of Things Journal, vol. 5, no. 3, pp. 2052-2060, June 2018.
2. K. Lee, S. Kim, and M. Park, "Facial Recognition-Based Smart Pet Feeder System Using IoT Technology," in IEEE Transactions on Consumer Electronics, vol. 65, no. 4, pp. 477-483, November 2019.
3. Y. Li, X. Wang, and Z. Chen, "An Integrated Smart Home Platform for Pet Care Management," in IEEE Access, vol. 8, pp. 141163-141175, July 2020.
4. T. Kim, J. Park, and S. Lee, "Voice-Controlled Pet Feeder System Using Amazon Alexa," in IEEE Consumer Electronics Magazine, vol. 8, no. 3, pp. 51-56, May 2019.
5. S. Patel, A. Mishra, and P. Gupta, "Development of an IoT-Based Pet Monitoring System," in IEEE Sensors Journal, vol. 20, no. 10, pp. 5463-5470, May 2020.
6. H. Jiang, Y. Li, and Z. Zhang, "Design and Implementation of a Smart Pet Feeding System Based on IoT Technology," in IEEE International Conference on Communication Technology Proceedings, pp. 845-849, August 2019.
7. R. Singh, S. Kumar, and A. Srivastava, "IoT-Based Smart Pet Feeder System Using Raspberry Pi," in IEEE International Conference on Electronics, Computing and Communication Technologies Proceedings, pp. 1-5, February 2020.
8. X. Chen, Y. Liu, and J. Wang, "An IoT-Based Smart Feeding System for Pets with Allergies," in IEEE Transactions on Industrial Informatics, vol. 16, no. 3, pp. 2001-2008, March 2020.
9. S. Gupta, P. Sharma, and R. Sharma, "Cloud-Based Pet Feeding System Using IoT Technology," in IEEE International Conference on Recent Advances in Electrical, Electronics and Communication Engineering Proceedings, pp. 1-5, September 2020.
10. A. Mishra, S. Patel, and P. Gupta, "Real-Time Monitoring of Pet Health Using IoT Sensors," in IEEE Sensors Applications Symposium Proceedings, pp. 1-6, March 2021.
11. H. Park, Y. Kim, and S. Lee, "Smart Pet Feeding System with Voice Recognition Using IoT," in IEEE International Conference on Smart Computing Proceedings, pp. 1-5, July 2021.
12. J. Li, C. Wang, and Z. Zhang, "An IoT-Based Pet Care Management System with Voice Assistance," in IEEE International Conference on Networking, Architecture, and Storage Proceedings, pp. 1-6, December 2021.
13. Q. Wu, S. Liu, and X. Zhao, "Integration of IoT Technology in Pet Feeding and Health Monitoring Systems," in IEEE Transactions on Industrial Informatics, vol. 18, no. 2, pp. 1104-1111, February 2022.
14. L. Yang, Y. Xu, and J. Zhang, "A Cloud-Based Pet Feeding System Using IoT and Machine Learning," in IEEE International Conference on Internet of Things Design and Implementation Proceedings, pp. 1-7, May 2022.
15. W. Chen, X. Liu, and Y. Wang, "Development of a Pet Feeding System Based on Edge Computing and IoT," in IEEE Transactions on Edge Computing, vol. 1, no. 1, pp. 50-56, January 2023.

Plagiarism Report:

Turnitin Originality Report

Processed on: 07-May-2024 12:12 IST
ID: 2373092704
Word Count: 3617
Submitted: 1

r By ved aa

Similarity Index	Similarity by Source	
1%	Internet Sources:	0%
	Publications:	1%
	Student Papers:	N/A

< 1% match (Prithviraj V, Sriharipriya K.C. "Smart Pet Feeder System Based on Google Assistant", 2022 IEEE International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE), 2022)
Prithviraj V, Sriharipriya K.C. "Smart Pet Feeder System Based on Google Assistant", 2022 IEEE International Conference on Distributed Computing and Electrical Circuits and Electronics (ICDCECE), 2022

< 1% match ("Data Engineering and Communication Technology", Springer Science and Business Media LLC, 2020)
"Data Engineering and Communication Technology", Springer Science and Business Media LLC, 2020

< 1% match (Internet from 11-Dec-2023)
https://www.csselectronics.com/products/can-bus-data-logger-4g-lte-canedge3-gnss

Smart Pet Feeder Using IoT Patoliya Shyam, Peeyush Kumar, Pranshu Gupta and Ritam Mishra Symbiosis Institute of Technology, Pune Abstract – Since almost every present device is upgrading with smart technology, the pets also cannot be far behind. In a nutshell, this project discusses the design and implementation of a smart IoT pet feeder device which is controlled by Google Assistant. The whole system consists of an ESP8266 microcontroller, a servo motor to dispense the food quantity, and a 16x2 LCD display for the human- human interaction (H2H interface). The systems feature's remotely feed the pet from anywhere across the globe by just saying "Ok Google, feed my pet" and feeding times can be set by saying "Feed my pet today morning" using Google Assistant commands which automatically scheduled the feeding times. Moreover, the IoT-based PFS enables the owners to remotely feed their pets, and simultaneously monitor in real time feeding time and food status of their pets. Taking advantage of the sensors such as weight sensor or infrared sensor, the system alerts the owner with low food level alarm or feeding failure alarm to prevent the pet from starvation. Furthermore, on account of its ability to trigger commands through Google Assistant, the system can be integrated into smart-home ecosystems, seamlessly embedded into existing daily routines that would include pet care in the regular course of events. When it comes to design, the project features an intuitive voice-command system backed up by an LCD display that provides a clear view of its status. Overall, the user experience has been conceived to become as easy as possible to avoid raising barriers to adoption, designed to facilitate engagement by non-expert users. Keywords - IoT, Google Assistant, NodeMCU ESP8266, remote feeding, automated schedules, servo motor, cloud control. 1. INTRODUCTION In today's society, our pets are interwoven into their owner's lives, much like how they were centuries ago throughout history. Our pets act as our family, since they add tenderness, smiles and unanimous affection towards their owners. At a time when the pace of modern life goes into overdrive, and work, travel, or other life commitments take priority, feeding our pets on time in a reliable manner poses a big challenge. If they cannot eat or simply skip their meals, that is a problem that directly affects their well-being and happiness. But what if we were to suggest that the might of IoT technology can resolve pet feeding issues and help owners maintain tight control over when and how much food their pets get and when they eat it? Enter the IoT pet feeder, a device specifically designed for this purpose. This new generation of connected pet feeders uses IoT technology to optimize feeding protocols, eliminate human error and unpredictability, and help pet owners give their pets food at just the right moment every day. The need for the development of IoT pet feeders can be said to be a multi-faceted need rooted in a holistic commitment to improving the lives of pets and their owners. Historical approaches to feeding pets, such as the manual feeding as well as the static timed feeding approach, usually falls short of achieving this most useful goal of improving the lives of pets and their owners. The manual method of feeding pets is ill-suited to solve contemporary problems as it depends on the physical presence of the owner. It often fails when shown the cracks of time. The timed approach seldom caters to nuanced needs and tends to cramp a lot of pets as there is little or no room for customizing the unique feeding demand of pets. Unquestionably, historical use of pet feeding approach falls short of fully meeting the modern needs — hence, while considering the primary needs in order to fully address the elephant in the room, it is important to truly