



# IOT AND ITS BENEFIT IN FEEDING DOMESTIC PETS \*

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## Abstract

*The Internet of things (IoT) is playing an important role in nowadays world due to its ability in describing physical objects with sensors that leads to exchanging data with other devices. For this case, we use the IoT technology in this study for solving the daily feeding problem of domestic animals and offering practical solutions to pet owners leads to respond to all requests that may be needed during the regular feeding of our pets. These requests can be pouring the determined amount of food into the pet's food container at the specified time intervals, controlling this process via the phone application created, giving an extra food with a button if desired, checking whether the pet has eaten the food by means of the weight sensor and informing the user via the phone application when necessary, controlling the pet or the environment with the camera, controlling the amount of food in the food storage tank via the ultrasonic distance sensor and informing the user. For validating this technology, we develop this method systematically and examine with practical development.*

**Key words:** Internet of things (IoT), pet, pet feeder

## 1 Introduction

Our pets, which have become a member of the family since the first day they entered the house, they are very valuable to us. Their health is extremely important as it is for every individual. However,

there is a subtle difference between us and them, and as long as they live in our homes, they are dependent on us for matters such as eating and drinking. As long as we give food, they will not go hungry, as long as we give water, they will not be thirsty. That's why keeping them healthy and not hungry and thirsty is the main duty of every pet owner. Most of the nutritional diseases seen in

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cats are caused by feeding defects. [1] The most obvious of these is due to irregular meal times, and to avoid this situation, their meals should be given at the same time intervals every day.

However, in today's conditions, although certain work groups have switched to working from home, the vast majority still continue to go to offices and workplaces. It is unacceptable for pets to stay at home hungry and thirsty while their owners are at work. It is not only the case of being at work, for example, if you are going on vacation, if you cannot take your pet with you and there is no one to stay with your pet at home, it will be impossible to go on vacation.

Today, Internet of things (IoT) and smart home systems have started to be used very widely. One of the important aspects of home automation system is to provide convenience for the consumer. It can be used to save energy and can be used at ease. [2] As we know, IoT is one of the most important features of the home automation system. It makes living easier for any person and is also beneficial for the disabled. [3] This project is thought to be very beneficial for disabled individuals to feed their guide dogs. Due to these beneficial features, there are many studies in the literature on IoT. IoT is a growing field and will continue to grow exponentially in the years to come. [4] There is even an opinion that the number of Connected Internet of Things (IoT) devices is predicted to reach 38.6 billion by 2025 and an estimated 50 billion by 2030. [5] As people began to be able to control objects remotely, they liked this comfort and wanted to continue it. With the development of technology, it has become possible to remotely control all electrical or non-electrical devices in a house in a smart way. Pet food bowls are one of these devices.

Although there have been different studies on automatic pet containers, there has not been one that covers all aspects and is as functional as it will be. In this work, it is aimed to create a product that includes solutions for the nutritional problems of our pets such as cats and dogs that we keep in our homes. It is not only possible to use it when you are not at home, but also when you are at home, to streamline the feeding time of the pet and to facilitate the user's work. By using the IoT, automated food for domestic pets can be provided which leads to help pets to be healthy. The remainder of this work is as following: Section 2 presents the various features of presented method. Section 3 describes the practical construction of pet feeder. Finally, Sec. 4 concludes this manuscript.

## 2 Features of the Presented Methodology

First of all, the most basic feature is to transfer the food to the food container in determined portions at specified time intervals. With this feature, the user will enter the desired time interval via the phone application and the animal will be given food at these time intervals. Figure 1 presents the initial perspective view of pet feeding automatically.

The intended secondary feature is to provide remote control of whether the pet has finished all of the food poured into the container, or how much of it. In this way, the hunger status of the animal can be estimated, and an extra meal can be given with the button in the application, if desired. Another part that needs to be controlled is the amount of food in the storage chamber. If there is no food left in this chamber, it may lead to starvation of our animal at meal times and negative consequences for its health. Therefore, it is extremely important to keep the occupancy rate of this chamber under control.

Being able to check the status of the house will be an added advantage, as the product is mostly designed for situations where you are not at home. With the camera on the ESP32-Cam card used in the project, the angle can be adjusted to watch the animal while it is eating its food or to view the environment, thus ensuring the safety of the environment. With a buzzer to be added to the product, an audible warning can be made, and it will be announced by the melody that the food is given. In this way, the pet will get used to this sound, and every time he hears this sound, he will understand that it is time for a meal.

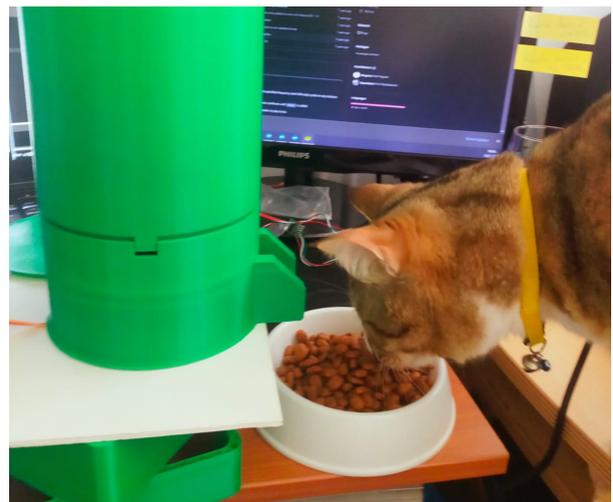


Figure 1: A perspective for pet feeding.

### 2.1 User Benefits

Designing a useful interface is important for the user. Therefore while designing the application, it

will be given importance to be useful. It is planned to reach the desired features with a simple interface and to meet all requirements. Being able to control the product through the application will also prevent waste of time. It will save the user the time of pouring the pet's food into the rough at each meal. In addition to all these, since the food will be poured from a closed chamber into the container without ever opening the lid, the food waiting in the storage chamber will not constantly get air, and staleness will be prevented.

### 3 Construction of Pet Feeder Through IoT

There is more than one way to achieve the right result when designing such a project and product. But choosing the most logical and practical one is an essential issue for the development of the project. Therefore, a detailed research is carried out before the construction phase. This section in detail introduces the performance and various features leads to design the pet feeder.

#### 3.1 Microcontroller and Component Selections

As a microcontroller, Arduino UNO board is evaluated in the first place and it was found very advantageous because it is a very common open source opportunity. However, extra devices are required for Wifi and Bluetooth connection and these increase the cost. Instead, it is thought that it would be more useful to choose the ESP32 card with built-in Wifi and Bluetooth connection. ESP32 cards also have their own models. The ESP32-CAM model, which also has a built-in camera, has been preferred because it will provide an extra feature to the product. Figure 2 shows the feature of ESP32-CAM component that will be used in this work.

Also, SG90 is used to perform the movement of the part that will be called the portion divider. Ultrasonic distance sensor is used in order to determine the amount of food left in the chamber where the food is stored and to provide this information to the user. The HX711 module and the load cell, which will be integrated with each other at the bottom of the container where the food is given to the pet, will help determine how much of the food the animal has eaten and how much it has not eaten, and will transfer it to the user.

#### 3.2 Application Perspective

The mobile application phase of this work is in an important position in terms of the usability of the product. Providing a user-friendly interface and



Figure 2: The feature of ESP32-CAM component.

avoiding complexity will be the basis for application selection. There are multiple platforms developed for designing applications. It is decided that suitable platforms for this project are Dabble, Blynk and MIT App Inventor applications. The main reason why these applications are suitable is that they can work in harmony with the Arduino IDE. Thanks to these features, these 3 platforms are mostly used in IoT-based projects. At the last stage, a selection was made between these platforms and Blynk was preferred. Figure 3 presents the diagram of Blynk platform.

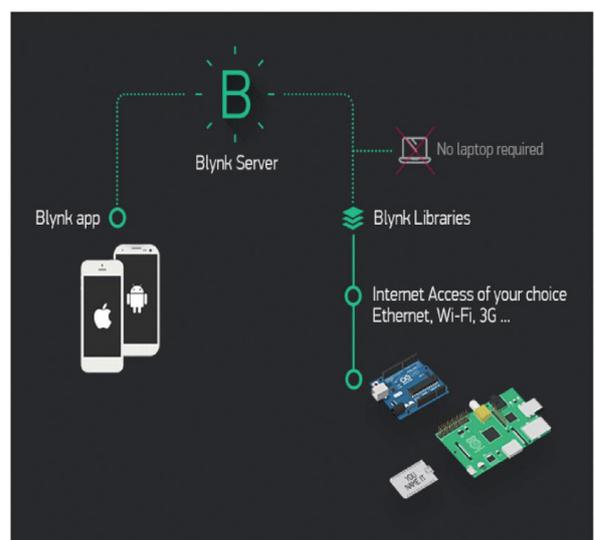


Figure 3: Blynk Working Diagram. [6]

Blynk App provides us the platform where we can easily turn our ideas into commercial IoT solutions.

With Blynk, we can implement IoT projects from your iOS and android devices. It provides an effective application platform where the user can create useful interfaces using their unique gadgets. Blynk can likewise store data and display the sensor's data information. It provides libraries for the vast majority of common equipment stages, such as Arduino, ESP8266, Raspberry pi, SparkFun and so on. [7]

Figure 4 presents the practical use of communication between the pet owner and container to show that there is either food or not. The application interface is describing in detail as following:

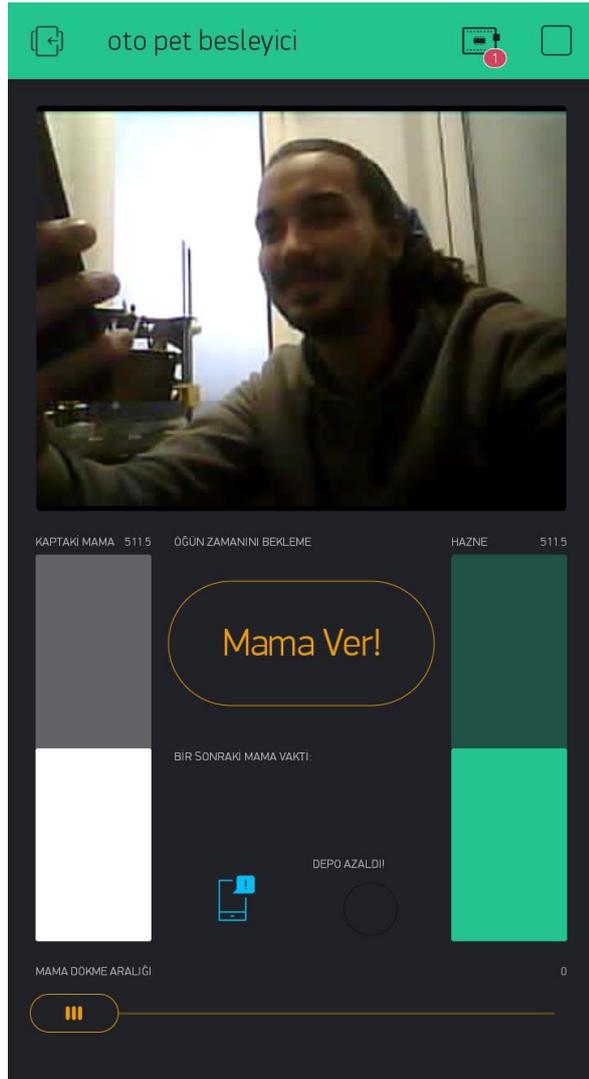


Figure 4: Application Interface.

The image information received from the ESP32-CAM card is transferred to the connection IP address of the card. This IP address is entered in the video streaming section of the Blynk application with the /mjpeg/1 extension, and the image taken from the card is instantly displayed on the application screen. In this way, the photographic images taken in instant jpeg format are projected one after the other and become a video.

With the slide button added in the application,

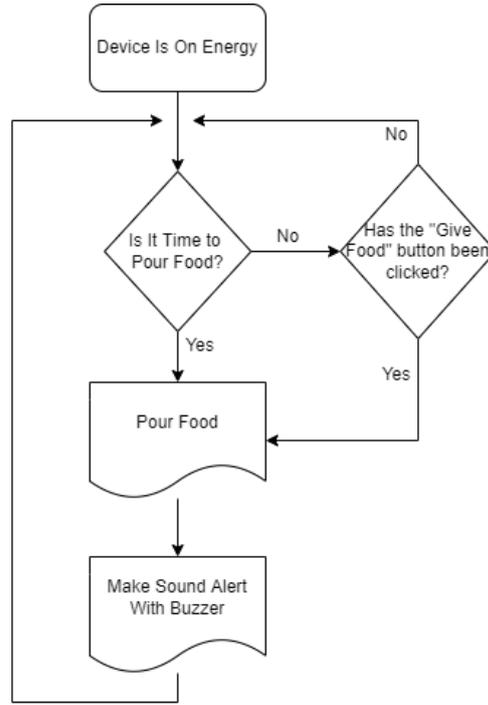


Figure 5: Flow Diagram.

the food pouring interval will be determined, the number determined in this interval will be assigned to the variable in the IDE, and that variable will start the counter. When this counter expires, the feeding process will take place. If it is not desired to wait for the food pouring time, the counter can be reset at that moment with the "Give Food" button and it will be possible to start the feeding process immediately. By means of the ultrasonic distance sensor to be placed in the storage chamber, the information about how much food is left in the storage chamber will be reached, this information will be sent to this plugin in the application using the serial begin communication command and the fill rate will be visually transferred to the user.

When the amount of food in the food storage chamber falls below the determined critical amount, the LED will light and give a warning to the user. A weight sensor will be used under the bowl where the food is poured. The information received from this sensor will be assigned to a variable in the IDE, and through this variable, it will be transmitted to this plugin in the application, and how much food is left in the container and how much of the pet's food has been presented to the user in a graphical form. Finally, the phone notification feature of the Blynk application has also been activated, and in this way, instant notification will be provided to the user without the need to enter the application in cases such as the decrease in the food in the chamber.

### 3.3 The Overall Design of Pet Feeder

This section presents the final schematic of pet feeder leads to automatically provide food through IoT. Figure 5 describes the in detail the steps lead to prepare food to the pets and Fig. 6 presents the overall structure of constructed pet feeder. The design was printed on a 3D printer with 1.5 mm layer height and %10 fill rate settings. The design has been tried to be prepared in such a way that the food can be delivered to cats or dogs in the most ideal way.

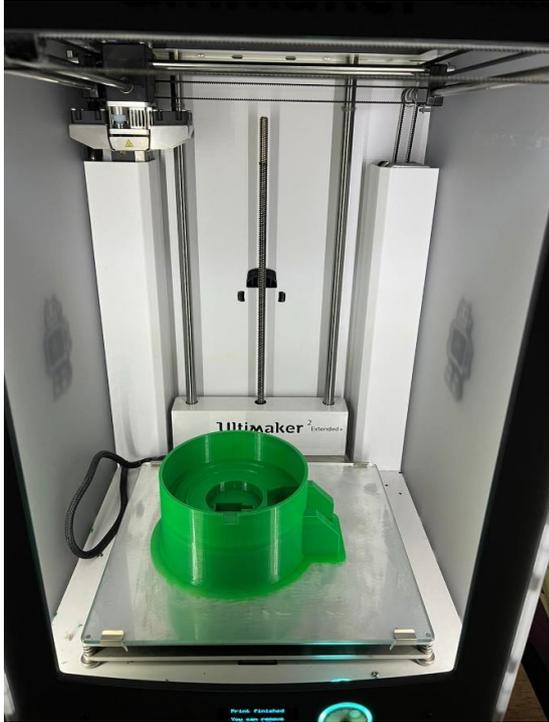


Figure 6: Printing Stage.

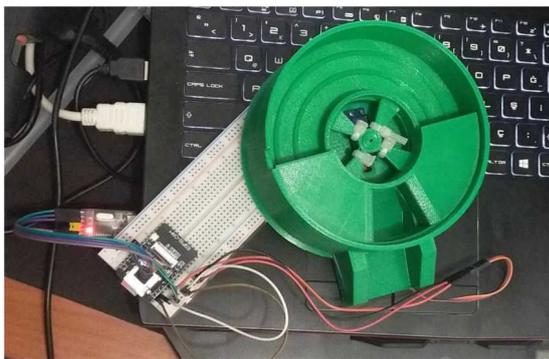


Figure 7: Portion divider in normal position.

Figures 7 and 8 show the portion divider part in the assembly phase. Normally, the piece that is in the position in Fig. 7 will move as in Fig. 8 when it is time to give food, in this case, it will be loaded into the food area in the tank. Then, when it comes back to its position in Fig. 7, it will pour the food



Figure 8: Portion divider in feeding position.

into the container. In summary, the practical and final view of pet feeder is presented in Fig.9.



Figure 9: Final and practical constructed pet feeder that is communicating through IoT.

## 4 Conclusion

In a market research conducted in this area, it is predicted that the Automatic and Intelligent Pet Feeder market will grow by 769.95 Million Dollars between 2020-2024. [8] According to the report, one of the biggest drivers in the growth of this market is the changing lifestyle patterns and busy work lives of the urban population. With these outputs, the importance of the project comes to the fore once again. In this work, the mechanism of checking whether the animal eats the food, which is not available in similar devices, and its useful interface attract attention. The presented steps and flowchart are considered as the working logic of the product and a successful result is obtained. Thanks to this working method, the owner will be able to feed his pet at desired time intervals, and when he wants,

they will feed his pet by using the button in the application.

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