IoT BASED SMART WAY OF WATERING PLANTS AND FEEDING PETS

Engineering Project for Community Services Report

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With specialization in

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Under the esteemed guidance of

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CERTIFICATE

This is to certify that the **Engineering Project for Community Services Report** titled **"IoT BASED SMART WAY OF WATERING PLANTS AND FEEDING PETS"** was prepared and presented by **V. SONIYA (198W1A0458), SK. KARISHMA (198W1A0452), D. VAMSI (198W1A0416), K. RAVI SHANKAR (198W1A0431)** of B. Tech., VIth Semester, Electronics and Communication Engineering in partial fulfilment of requirements for award of the Degree of Bachelor of Technology in Electronics and Communication Engineering under the Jawaharlal Nehru Technological University Kakinada, Kakinada during the year 2021-2022.

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DECLARATION

We here by declare that the work is being presented in this EPICS **"IoT BASED SMART WAY OF WATERING PLANTS AND FEEDING PETS"** submitted towards the partial fulfilment of requirements for the award of the degree of **Bachelor of Technology in Electronics and Communication Engineering** in V. R. Siddhartha Engineering College, Vijayawada is an authentic record of our work carried out under the supervision of our guide **Mr. R. V. H. PRASAD, M. Tech (Assistant Professor)** in ECE Department, in V. R. Siddhartha Engineering College, Vijayawada. The matter embodied in this dissertation report has not been submitted by us for the award of any other degree. Furthermore, the technical details furnished in various chapters of this report are purely relevant to the above **EPICS PROJECT.**

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Abstract

Plants and animals are most important in our livelihood. Plants are useful for the oxygen purpose, stability of nature and needs of humankind. Pets are useful to decrease stress, anxiety, and loneliness. Like humans, they also need water and food to live. For forest animal's nature provides all necessary conditions to live. But, for farming plants & animals, and indoor plants & pet animal's humans have to take the responsibility to provide all necessary conditions including water and food.

The main purpose of our project is to provide water for indoor plants and food for the pets when possessors go out for a noticeable duration of time. We are proposing an IoT-based smart automatic watering and feeding system for indoor plants and pets, respectively.

Keywords:

Indoor Plant, Pets, IoT-based watering and feeding system.

CHAPTER-1

INTRODUCTION

We chose this project because pet keeping is a time consuming responsibility and we want to provide convenience to owners by helping them feed their pets easily and smartly.

Automatic pet feeder is one of the new technologies for feeding pet. It will help pet owner to take care of their pet while they are not at home. Even the owners are not at home, they still can feed their pet. Automatic pet feeder is built to help pet owner care of their pet. IoT pet feeder is one of the pet feeders that will be controlled by a mobile application through internet. The automatic pet feeder will automatically dispense predetermined amount of food and water to the bowls.

As pet lovers, users should understand those pets also need a proper diet management. Whether user away from home unexpectedly or simply one less chore to worry about, user can feel secure that the beloved pet will be cared for and fed on time every time.

The Automatic pet feeder will solve two problems which pet owner face i.e., making sure that each pet has access to a healthy amount of food throughout the day, regardless of the owner's schedule. Making sure that each pet eats only its own food though there are a variety of products on the market which solve the first problem, there are none which address the second.

The automatic pet feeder will give pet owners a solution to both problems, thereby improving the lives of both pets and owners by allowing the owner to reliably provide food to a pet at the time the owner wishes and keep the pet from reaching the food stored later feedings. Many animal feed systems can be designed to function as an automatic device that allow the user to feed whenever he from anywhere through internet. The purpose of having sensors in a system like this is to automate the feed process completely with less human interference.

CHAPTER-2

OBJECTIVE :

Our project is designed to help all the pet owners to feed their pets remotely and smartly.

Benefits to customer:

- Owners will be able to feed the correct amount of food to their pets by setting it on the phone app. The information will be transferred to the PCB via Bluetooth, which will send signals to food dispensing gates.
- Owners will be able to monitor their pet's health condition via their daily consumption of food recorded by the app. Sensors will be embedded on the food plate, which measures the difference of weights by the end of each day. Information will be processed by PCB and sent to the phone app.
- Owners with two different types of pets will be able to feed them separately with corresponding food.
- In particular, a household can have dogs of different ages that need different food; or if the owner owns both dog and cat and does not want them to eat the wrong food by accident.
- Each pet will have a RFID tag.
- When the RFID receiver identifies the type of animal, the correct angle of food plate will be spinned so that the corresponding food will be exposed.

CHAPTER-3

3.1. Microcontroller :

We choose to use AVR 8-bit microcontroller because it provides a nice compatibility with any of the other modules on the market. 8-bit is also sufficient for our purposes. The microcontroller is the central control unit of the whole system. It will be collecting many inputs. This includes: measurement from sensors, which will be transferred to phone devices via Bluetooth; RFID activation signal from the reader, which will be processed in the microcontroller; data acquisition signal from the Bluetooth, which asks the daily food consumption data stored inside of the microcontroller. The microcontroller also generates several outputs. First, after receiving triggered signal of RFID, it will look up the angle to spin for the round food plate if current exposed region is not for the particular animal. Second, when the weight sensor on the food plates measures insufficient amount of food, the microcontroller will signal to rotate the gate by the precalculated angle and dispense 100 grams of food for the animals. We chose to dispense100 grams of food at once to make sure that the dispensing process is in a range that we can control and it also helps minimize collateral damage in case the pet trips the machine over and spills all the food. Once the total amount dispensed has reached the upper limit that the own set, no more food will be able to dispense. This feature helps prevent overeating problem of pets. The microcontroller will be storing the weight of remaining food in the containers only when there is an action of food dispense, while storing the food weight on the food plates a regular time to keep track of animals food consumption. In addition, the microcontroller also stores the consumption data which will be transferred to the phone upon Bluetooth request.

3.2. INTERNET OF THINGS

Internet of Things (IoT) is the networking of physical objects that contain electronics embedded within their architecture in order to communicate and sense interactions amongst each other or with respect to the external environment. In the upcoming years, IoT-based technology will offer advanced levels of services and practically change the way people lead their daily lives. Advancements in medicine, power, gene therapies, agriculture, smart cities, and smart homes are just a very few of the categorical examples where IoT is strongly established.

Over 9 billion 'Things' (physical objects) are currently connected to the Internet, as of now. In the near future, this number is expected to rise to a whopping 20 billion.

There are four main components used in IoT:

1. **Low-power embedded systems:** Less battery consumption, high performance are the inverse factors that play a significant role during the design of electronic systems.

2. **Cloud computing:** Data collected through IoT devices is massive and this data has to be stored on a reliable storage server. This is where cloud computing comes into play. The data is processed and learned, giving more room for us to discover where things like electrical faults/errors are within the system.

3. **Availability of big data:** We know that IoT relies heavily on sensors, especially in real-time. As these electronic devices spread throughout every field, their usage is going to trigger a massive flux of big data.

4. **Networking connection:** In order to communicate, internet connectivity is a must where each physical object is represented by an IP address. However, there are only a limited number of addresses available according to the IP naming. Due to the growing number of devices, this naming system will not be feasible anymore. Therefore, researchers are looking for another alternative naming system to represent each physical object.

There are two ways of building IoT:

1. Form a separate internetwork including only physical objects.

2. Make the Internet ever more expansive, but this requires hard-core technologies such as rigorous cloud computing and rapid big data storage (expensive). In the near future, IoT will become broader and more complex in terms of scope.

IoT Enablers :

1. **RFIDs:** uses radio waves in order to electronically track the tags attached to each physical object.
2. **Sensors:** devices that are able to detect changes in an environment (ex: motion detectors).
3. **Nanotechnology:** as the name suggests, these are extremely small devices with dimensions usually less than a hundred nanometers.
4. **Smart networks:** (example: mesh topology).

Characteristics of IoT:

1. Massively scalable and efficient
2. IP-based addressing will no longer be suitable in the upcoming future.
3. An abundance of physical objects is present that do not use IP, so IoT is made possible.
4. Devices typically consume less power. When not in use, they should be automatically programmed to sleep.
5. A device that is connected to another device right now may not be connected in another instant of time.

6. Intermittent connectivity – IoT devices aren't always connected. In order to save bandwidth and battery consumption, devices will be powered off periodically when not in use. Otherwise, connections might turn unreliable and thus prove to be inefficient.

As a quick note, IoT incorporates trillions of sensors, billions of smart systems, and millions of applications.

Application Domains:

IoT is currently found in four different popular domains:
1) Manufacturing/Industrial business - 40.2%

2) Healthcare - 30.3%

3) Security - 7.7%

4) Retail - 8.3%

Modern Applications:

1. Smart Grids and energy saving
2. Smart cities
3. Smart homes
4. Healthcare
5. Earthquake detection
6. Radiation detection/hazardous gas detection
7. Smartphone detection
8. Water flow monitoring
9. Traffic monitoring
10. Wearables

3.3. ALGORITHMS:

Description:

Internet of Things (IoT) has quickly grown into one of the hottest areas in the field of wireless communication and mobile computing. IoT has broad coverage from personal networks or home networks to medium/large scale networks such as WAN/5G. IoT devices are heterogeneous and vary in terms of computation power, communication, and networking capability

As well as battery life. Despite their differences, IoT applications have the common fundamental problems that need to be addressed by the proper algorithms within certain contexts. For example, the algorithms of scheduling, optimization, flow control, and area coverage have a broad application in IoT for purposes such as resource access, networking, collaboration, and management.

The central theme of this special issue is to investigate novel algorithmic solutions for a broad range of IoT applications and highlight the algorithmic foundations that could serve for multiple similar applications so that researchers can efficiently investigate the state of the art in a field, link similar problems under different contexts, and find effective theoretical tools to build solutions for the specified applications.

This special issue encourages submissions of research articles reporting original work in theoretical research and review articles summarizing the algorithmic foundations that have been applied investigated to solve similar problems in Internet of Things.

Potential topics include but are not limited to the following:

- IoT Resource Management Algorithms
- IoT Security and Privacy Algorithms
- IoT QOS Algorithms
- IoT Machine Learning based Algorithms
- IoT Communication Protocols and Algorithms
- IoT Algorithms for Temporal Networks

3.4. ESP8266 NODE MCU:

Node MCU is an open-source Lua based firmware and **development board** specially targeted for IOT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SOC from Espressif Systems, and hardware which is based on the ESP-12 module.

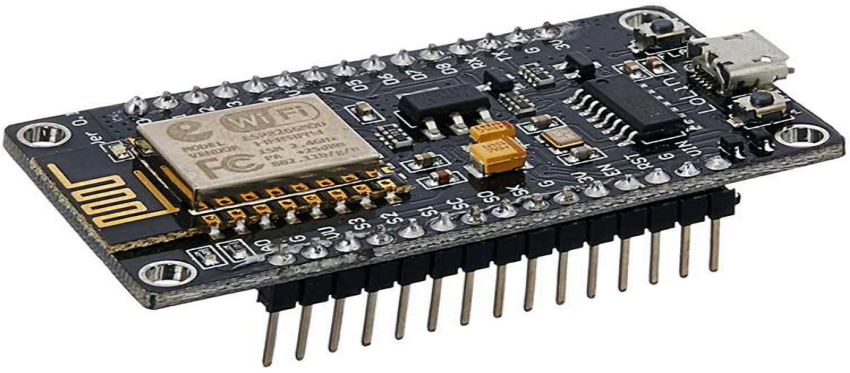


Fig.3.4.1 ESP8266 NODE MCU

Uploading your first program

Once Arduino IDE is installed on the computer, connect the board with the computer using the USB cable. Now open the Arduino IDE and choose the correct board by selecting **Tools>Boards>NodeMCU1.0** (ESP-12E Module), and choose the correct Port by selecting **Tools>Port**. To get it started with the Node MCU board and blink the built-in LED, load the example code by selecting **Files>Examples>Basics>Blink**. Once the example code is loaded into your IDE, click on the 'upload' button given on the top bar. Once the upload is finished, you should see the built-in LED of the board blinking.

Applications

1: Prototyping of IoT devices

2: Low power battery operated applications

3: Network project

4: Projects requiring multiple I/O interfaces with Wi-Fi and Bluetooth functionalitie

PIN DIAGRAM:

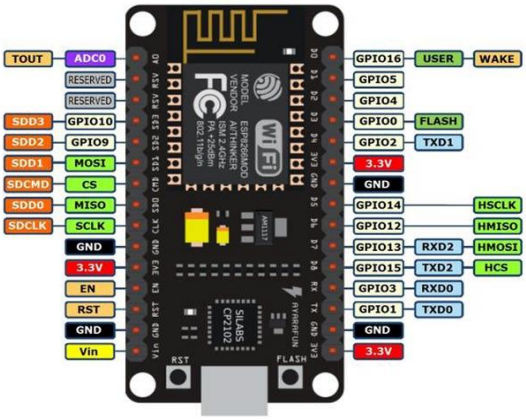


Fig.3.4.2 ESP8266 NODE MCU Pin Diagram

Node MCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SOPC from Espressif Systems, and hardware which was based on the ESP-12 module.

Specifications for ESP8266 Node MCU:

a. Clock speed- 80 MHZ

b. Voltage – 3.3V

c. Digital I/O pins- 11

d. Analog I/O pins – 1

e. Node MCU – 58mm x 32mm

How to use a ESP8266 Node MCU

Open the serial monitor and open the URL shown in your serial monitor through your web browser. Connect GPIO 2 of the ESP8266 to the longer lead of the LED (+ve terminal). Now you can control the LED remotely through the internet! Click on the respective hyperlinks in your browser to toggle the LED ON and OFF.

3.5. SERVO MOTOR

A servo motor is a rotary actuator that allows for precise control of angular position. It consists of a motor coupled to a sensor for position feedback. It also requires a servo drive to complete the system. The drive uses the feedback sensor to precisely control the rotary position of the motor.

Fig.3.5.1 Servo Motor

It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. Servomotors are not a specific class of motor, although the term servomotor is often used to refer to a motor suitable for use in a closed-loop control system. Servo motors are part of a closed-loop control system and consist of several parts namely a control circuit, a servo motor, a shaft, a potentiometer, a drive gear, an amplifier, and either an encoder or a resolver. A servomotor is a self-contained electrical device that rotates parts of a machine with high efficiency and great precision.

Mechanism Of Servo Motor

A servomotor is a closed-loop servomechanism that uses position feedback to control its motion and final position. The input to its control is a signal (either analog or digital) representing the position commanded for the output shaft.

The motor is paired with some type of position encoder to provide position and speed feedback. In the simplest case, only the position is measured. The measured position of the output is compared to the command position, the external input to the controller.

If the output position differs from that required, an error signal is generated which then causes the motor to rotate in either direction, as needed to bring the output shaft to the appropriate position. As the positions approach, the error signal reduces to zero, and the motor stops.

The very simplest servomotors use position-only sensing via a potentiometer.

Specifications for Servomotor:

a. Frequency – 80/160 MHz

b. Digital I/O pins – 17

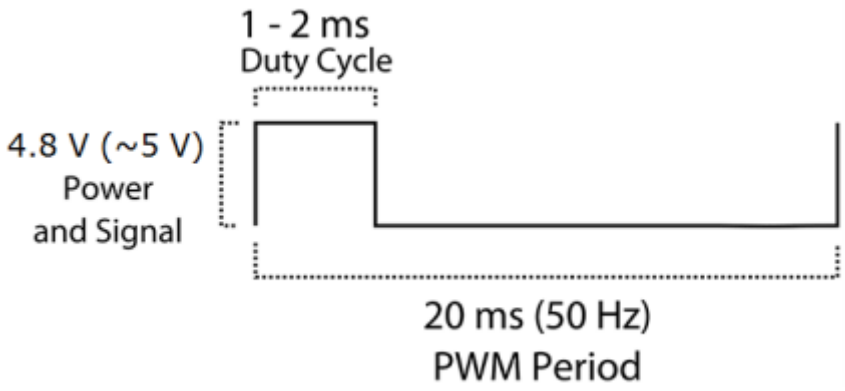
c. Operating voltage – 3.0~3.6 V

d. Program memory – 4MB

How to use a Servo Motor

After selecting the right Servo motor for the project, comes the question how to use it. As we know there are three wires coming out of this motor. The description of the same is given on top of this page. To make this motor rotate, we have to power the motor with +5V using the

Red and Brown wire and send PWM signals to the Orange colour wire. Hence we need something that could generate PWM signals to make this motor work, this something could be anything like a 555 Timer or other Microcontroller platforms like Arduino, PIC, ARM or even a microprocessor like Raspberry Pie. Now, how to control the direction of the motor? To understand that let us a look at the picture given in the datasheet.



CHAPTER-4

METHODOLOGY:

Automatic Pet Feeder using Microcontroller Node MCU will feed the pets whenever the owner wishes. With the press of a button from anywhere in Blynk mobile application through internet the user can feed their pet. This system is very user friendly. Dispensing dude consists of a container that acts as storage for the food, dc motor to mechanize the dispensing action and a Node MCU with motor driver to control the motor. Basically, the output current offered by developing boards like Node MCU is in the order of 40mA and dc motors require a good 500mA to drive them that is why the motor driving shield comes in. The logic behind dispensing action is whenever the user presses the button in Blynk app through internet to switch on the dc motor which is connected to spinner.

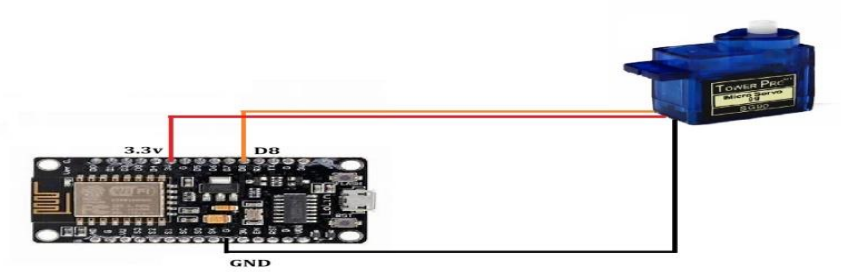


Fig.4.1 Circuit diagram

Here the spinner is a mechanism to dispense food. The dc motor rotates the spinner, spinner dispense the food into the bowl slowly. As well as the user can serve the water to his pet whenever he wishes. Whenever the user presses the button in Blynk app through internet to switch on the water pump which is inserted into the water can. The water pump pumps the water into the water bowl of his pet only if there is no Water.

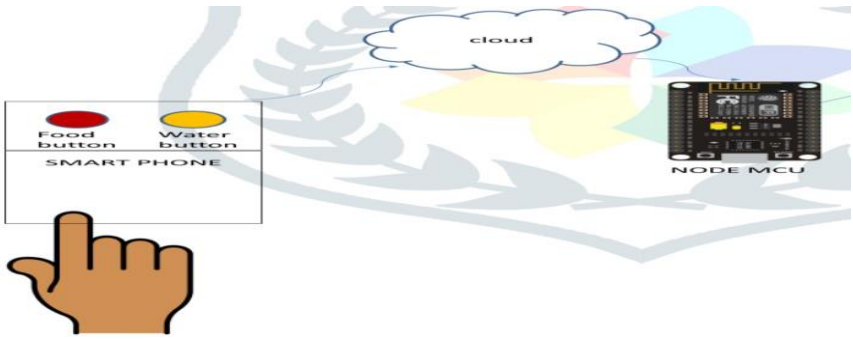


Fig.4.2 Food motor working model

The logic behind this is we are using an ultrasonic sensor to check whether water is there or not. The ultrasonic sensor is used to measure the distance of an obstacle. Here, the obstacle is water if there is water or the bottom of the bowl if there is no water. If distance is greater than or equal to the approximately the bowl height means there is no water in the bowl. At this moment if user presses the button to switch on the water pump, the pump will start. Otherwise the motor will not start. We use this ultrasonic sensor logic to reduce the wastage of water as possible.

BLOCK DIAGRAM :

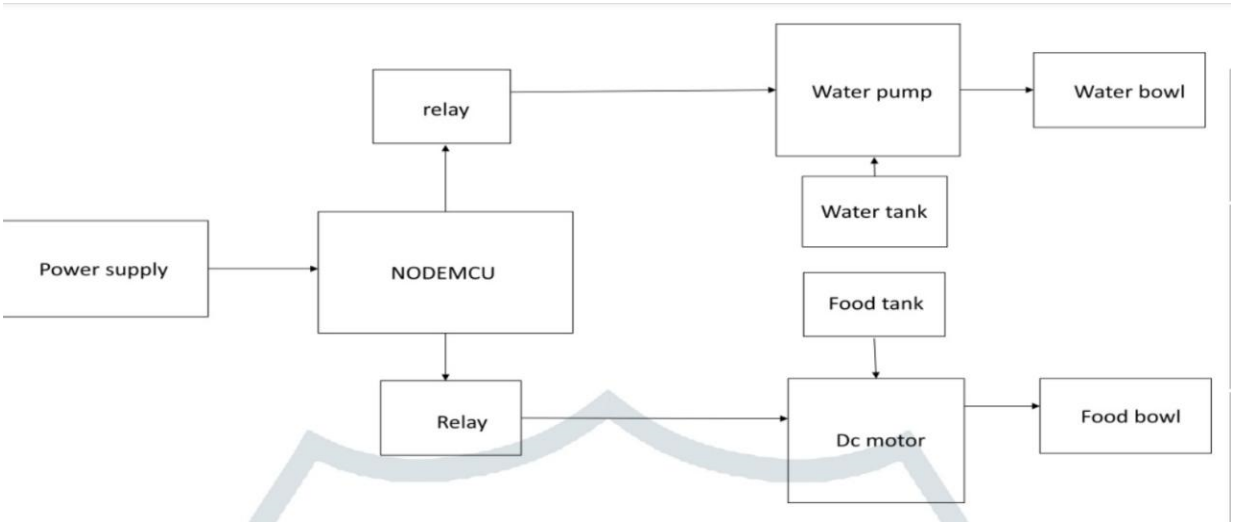


Fig.4.3 Block diagram

CHAPTER-5

RESULT:

Automatic pet feeder works efficiently and fulfils the objective of feeding pet in absence of its master. It works on 9v D.C. supply. The servomotor rotates the propeller and food gets delivered into the plate as programmed in the Node MCU. The whole system is connected to the mobile phone via internet using an online cloud portal called blynk cloud. If any interrupt is occurred in the blynk app it is transferred to the microcontroller unit through internet. For example, in order to start food motor on we have to press on button in the blynk app, then the signal is transmitted Node MCU there by it turns on the servo motor which guides the food down to the food bowl through propeller.

Output in blynk app :

Fig.5.1 Output in Blynk application

The above image shows the output of the pet feeder in the blynk application. We can see that it consists of three pins, these are called virtual pins. These are connected to digital pins of the board through internet. The virtual pin v1 is connected to food relay, virtual pin v2 is connected to water relay, virtual pin v3 is connected to ultrasonic sensor. We can run the system by pressing the triangle in the right top corner of the blynk app.

Output in blynk app :

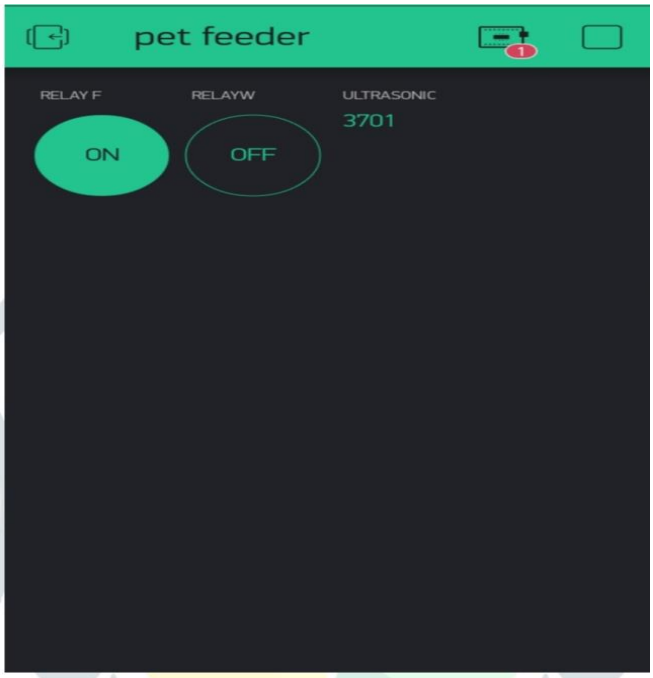


Fig.5.2 Relay in Blynk application

After pressing the run button, the system looks like the one shown in the above figure. We can switch on and off the food and water relays by pressing the on them. If we press the on button in blynk app the signal is transferred to board and the motor gets on.

Fig.5.3 Prototype Model

CHAPTER-6

CONCLUSION :

The interaction between humans and physical devices and objects is attracting increasing attention. Many studies have attempted to provide a natural and intuitive approach to request services. The current trend of combining pet control and IoT technology offers exciting future developments. The proposed system is also referred on smart-home technology, including the smart pet door and pet feeder. The results not only present the key improvement of the pet monitor system involved in the IoT technology, but also meet the demand of pet owners. The basic vision behind the IoT, it may have a new way of operational method, it may have a new method of connecting devices, and there might be the even complete clean-slate approach. As the full operational definition is finalized, but there are numerous research issues that can be worked on. As a next step, we will fully integrate the other pet care devices into our system, including litter boxes, pet cam, etc. With that, the diverse needs of the owners can be met, and the health, monitor, and entertainment topics for pets are all covered. Besides, standing as the cloud term, how to connect the numerous networking devices around the globe is the next issue. In the future, we will centralize on the study of the IoT gateway and long-distance detection of the pets.

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