Smart Feed Automatic Pet Feeder,

Wi-Fi Enabled Pet Feeder

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1. INTRODUCTION

Dog and Cat is the commonest pet that people owned. Nowadays Pets is additionally one among friend to the owner. So, Pets healthiness is vital. Regular feeding is the most important thing, but it also one among the issues in Pets maintenance. Owners often forget to feed their pets due to their work. A Smart Feed Automatic Pet Feeder will be the solution to those problems.

Now there are some pet feeders that are created. But the author sees there are some features that also will be added to the feeder tools. One among the feeders the author found still needs to be set manually. It also has an alarm, but users even have to line manually on the devices. Therefore, the author wants to create feeding the process more efficient for the user.

The Internet of Things concept have given ideas for the author. Internet era can help every work to be easier than it should. Making a pet feeder to be smart will be done by adding the Internet of Things concept. Pet feeder will be smart with adding some new technologies and makes it able to interacts with other devices. Therefore, the authors wants to create a sensible pet feeder to unravel this problem.

Smart Feed Automatic Pet Feeder is meant with RFID to authenticate your pet’s tag, in order that the other dog and cat cannot access the device. It can set feeding time and portion per serving through Smartphone, send feeding report (eaten or partially eaten), and Pet arrival when the feeding time has arrived.

Smart Feed Automatic Pet Feeder has stock information, feed schedule, waiting time and owner’s name from server uses MQTT protocol. All information are sent in JSON format and can be processed by Smart Feed Automatic Pet Feeder, Smartphone and server. Smart Feed Automatic Pet Feeder will save the schedule and set an alarm which is able to interrupt when the feed time has arrived. It also encompasses a load cell sensor to measure serving size supported user’s setting.

Smart Feed Automatic Pet Feeder is very useful for Pet’s owners who have a busy schedule and sometimes leaves home. The owners do not must worry about leaving their dogs reception and might monitor their diets through his smartphone.

1. METHODS

OVERALL SYSTEM DESIGN

Smart Feed Automatic Pet Feeder, Wi-Fi Enabled Pet Feeder communicates with server through WiFi module ESP8266 development board, NodeMCU, with MQTT protocol over SSL/TLS. All data received by ESP8266 will be formatted as JSON object and sent to Arduino to be processed. ESP8266 also tasked to send data to server from Arduino.

MECHANISM DESIGN

1. *Smart Feed Automatic Pet Feeder, Wi-Fi Enabled Pet Feeder.*

Smart Feed Automatic Pet Feeder is designated with Arduino Uno microcontroller at its core. it's liable for controlling the flow of main program, further as controlling all the sensors and the actuators used. The microcontroller is additionally responsible for all data exchange (in this case JSON objects) between Smart Feed Automatic Pet Feeder and User’s Smartphone through ESP8266 WiFi module.

The components used for Smart Feed Automatic Pet Feeder are RC522 RFID reader and tag, load cell from gold weighing scale, HX711 weighing module, Arduino UNO, servo motor DF15RSMG, real clock DS3231, magnetic switch, LM2596, screw shield, ESP8266 WiFi module, and 12V adaptor.

Servo motor is used to rotate the propeller blade used as dog food pouring mechanism. Real time clock is used to give time to Arduino and set feeding schedule. Magnetic switch is used to detect the lid on the dog food container as an “update stock” mechanism. LM3596 is used to reduce voltage from 12V to 5V as a power source for every components. ESP8266 WiFi module which is installed with NodeMCU firmware is used to communicate.

The specification of Smart Feed Automatic Pet Feeder in this paper are:

1) Maximum capacity of dog food is 1 kg;

2) Dog food that can be used is dry food and has round shape;

3) Available portions are 1/3 cup (76 grams), 2/3 cup (150 grams), and 1 cup (227 grams);

4) Smart Feed Automatic Pet Feeder designed for small to medium dog (12 – 30 cm) and feeds one dog;   
5) Android devices that can use the application has a minimum version of JellyBean and SDK 18;

6) Measurement of weight of the food only until digit unit in gram;

1. *Appliance Hub Application*

Appliance Hub application uses Paho Android Service to connect MQTT server. A certificate is needed when the Android application is trying to establish a connection with the server. Initialization begins when user logs in to the application and create MQTTAndroidClient. Afterwards, the communication occurs through publish function to send command and

Main activity in the application is Sign In Activity. If a user has not registered, they have to register on the Sign Up page with choosing “Sign Up” option. After sign in or sign up process is done, user can choose the Account Setting or Appliance menu. If they choose the Account Setting menu, they can make changes of their profile or password. However, if they choose the Appliance menu, they will see lists of their appliances. User can chooses one of them and gives command to the appliance. For giving new command to Smart Feed Automatic Pet Feeder, the user will be in the Feed Activity which contains some EditText to input serving size, how many time(s) they want to feed and how long they want to wait to check feeding

1. RESULTS

IMPLEMENTATION

*A. Measuring Implementation*

The first trial was done to ensure the accuracy of the load cell. In this research, the author compared the measurement between load cell and reference scale when used to measure a 100 grams weight. The load cell read 78 gram and the reference scale read 100 grams. There was a deviation between them in the amount of 22 grams. To perform a calibration, the author compared three other amounts in different weight, such as 200 grams, 300 grams, and 400 grams. The result can be calibrated with curve fitting process on Matlab. Therefore, the measurement of the load cell has to be calculated according to formula 4.1.

F(x) = 1.279 \* x + 0.6541 (4.1)

Where:

x = load cell measurement in gram

*B. Feeding Implementation*

Feeding trial was done by testing the entire mechanism, such as real time clock alarm, RFID reader, servo motor, and the measurement of load cell until the serving size had been reached. The result showed that real time clock and servo motor could work as desired. RFID reader could also detect the tag that was attached to dog’s collar, but there was a limitation with reading distance. RFID reader that was used in this research could only read a maximum distance of 2.5 cm safely without any error, although the datasheet suggested that the maximum distance was 3 cm.

*C. Hardware Implementation*

RTC DS3231 SDA pin is located at A4 pin and SCL pin is located at A5 pin because they communicate with I2C. ESP8266 board communicates through serial communication. Therefore, ESP8266 TX pin is located at RX pin on Arduino and RX pin is located at TX pin. The MFRC522 RFID pin also has spesific pin location to support SPI communication. The servo motor is also located at one of the PWM pins on Arduino. Other components can be located anywhere. Buzzer is located at digital pin 2, magnetic sensor is located at pin digital pin 4, and HX711 weighing module is located at A2 (DT) and A3 (SCK). Pin E+ on HX711 is connected to red wire on loadcell, pin A+ on HX711 is connected to white wire on loadcell, pin A- is connected to green wire on loadcell, and pin E- is connected to black wire on loadcell.

*D. System Implementation*

System implementation consists of application implementation with responses from the server. All communication is also listened by Wireshark application to check the security aspect. The complete implementation can be seen at author’s report .

1. DISCUSSION

PREVIOUS RELATED RESEARCHES

There are few previous researches that are done about automatic pet feeder, like Programmable Pet Feeder and Smart Pet Care System. They're not exactly addressed to feed pet generally. Programmable Pet Feeder is feeding automatically using microchip PIC18F4520 microcontroller. A stepper motor is employed to regulate the speed and position and a DC motor to dispense food. The food dispenser is known as Turn-Table which divides into Four sections and can dispense different reasonably foods. Buzzer is employed to alert when feeding time was arrived and therefore, the meal is served. User can set the schedule for every section using the LCD and input their desired timing.

Smart Pet Care System consists of an automatic feeder, an automatic pooping pad, a camera with Raspberry Pi, and an application for smartphone. Automatic feeder has 3 layers to dispense and distribute the food. It uses Arduino to manage the feeding mechanism and a weight sensor to live serving the size. A Raspberry Pi camera is employed to observe automatic feeder and pooping pad. The Raspberry Pi also acts as server. In the application, user can choose to serve size and also the schedule for 333 times feeds. Unfortunately, the applying is made in Korean language.

From two examples about automatic pet feeder, the author wants to create a feeder which is connected to a system that completes those two feeder. Programmable Pet Feeder only has 4 dispensers which suggests it can only serve 4 times and it requires the user to line the days at the device. Smart Pet Care System will be set with a smartphone but the user can’t see the record of the feeding process. It provides camera but the user has to watch it to seek out out what their pet is doing.

Smart Feed Automatic Pet Feeder is addressed to feed small to medium size dog. it's an authentication system using RFID and is connected to a system called Appliance Hub which is encrypted with SSL/TLS. User can control Smart Dog Feeder using the Android application. the applying is meant to set feeding schedule, monitor the processes, update food stock, and register or unregister the device(s). User can choose the amount per serving and set what percentage times the feeder will serve (once to thrice a day). This application is straightforward to use because it’s made in English language.