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DOG DAY CARE HELPER USING RASPBERRY PI

Minerva C.Zoleta

[1]Faculty ofComputer Engineering,
Eulogio "Amang" Rodriguez Institute of Science and Technology,
Nagtahan, Manila

Corresponding Author's Email:[1]mzoleta@yahoo.com

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ABSTRACT: The study focuses on the design and development of an automated Dog Day Care Helper using Raspberry Pi to assist pet owners who are young and busy professionals. Prototyping technique has been adopted with consideration to developmental research that required fabrication and innovation from modular to a full-scale working model, design sampling or a revised version of the existing designs to test the concept. Accuracy and reliability determine system quality output. This proves the viability of the design for an automated pet care system capable of dispensing the desired amount of dry feeds, activating the shower and blow-dry modules, washing out of pet litters, disposing of left over feeds at pre-defined schedules. Attention to basic functions has been considered in the current design, but it is customizable for enhancements and additional features by programming the GPIO of the raspberry pi. The system design codes were written in Python programming language to control the system. Acting as one system, modules have been integrated, but are programmed independently to control the individual hardware. The Automated Dog Day Care Helper System will give our dogs the experience of personal care in our moment of absence.

KEYWORDS:*Raspberry Pi; Dog Day Care Helper; Automated Pet Care; Python; Jessie*

1.0 INTRODUCTION

Dogs are coined to be "Men's best friends". Around the globe, the Philippines ranked 6th with the most number of dog pets with 11.6 million as compared to U.S. that ranked 1st with 75.8 M [1]. According to the article "Top 10 Most Popular Dog Breeds in the Philippines" are Shih Tzu, Chihuahua, Pomeranian, Siberian Husky, Beagle, Labrador, Chow chow, Pug, Poodle and German Shepherd in order [2]. A hindrance to having any of these breeds is the acquisition and maintenance cost. One third or approximately 35 M of the Philippine population are the so-called Millennials or "Yuppies" (young professionals) [3]. They are upbeat, selfie-gen, tech-savvy and lazy. 56 % of their population are eager to try new technology while 75 % want to travel abroad. In the U.S., Millennials tend to delay traditional life milestones like marriage, home-owning and childbearing. 35 % of them opt to adopt pets. Yuppies worry about their pets when they have to go overtime, out of town seminar or training or a weekend getaway and leave their pets home alone. It's a big problem to think about how your pet is going to survive

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without you even for a short period. Who is to take care of the dog, where to leave the dog, what to eat, when to eat are some of the questions that bother the owner when away.
Elliot, an author of the article "How to Take Care of a Dog" emphasizes that dog care requires proper feeding, health care and treatment with respect and love [4]. An article entitled "The Dog Spa and Hotel" mentioned that there are existing dog grooming centers in Metro Manila that allows pet relaxation on a comfortable couch in an airconditioned and spacious room [5]. It also offers spa services for softening hair, massage and anti-flea bath. Lounging area for pet owners are also available in their facility. They also offer overnight stays for pets. All these services entail a reasonable cost.
The study attempts to develop an automated system using existing technology with the ability to lessen human intervention in pet care yet maintain the pet and owner relationship. Although there isnumerous pet care systems that exists, such as feeding, bathing, litter cleaning, these systems provide only a feature or two. The study will allow the pet owner to take care of his pet during his absence for a day or two doing pet feeding, bathing, blow-drying and washing off the waste bin of the kennel when necessary. This will also keep the pet safe and secured inside the kennel to avoid untoward incidents during the owner's absence. The system can be placed inside or outside the house near a water source for bathing and kennel cleaning purposes and drainage for waste disposal.
Raspberry Pi computer was used in this study. RasPi is a credit-card size single-board computer developed by UK RPi Foundation for use as embedded computer controller equipped with memory, CPU, Graphics Processing Unit (GPU), Ethernet port, XBee socket, Universal Asynchronous Receiver/Transmitter (UART), display, power source and General Purpose Input and Output (GPIO) pins to control electronic components for physical computing and explore the Internet of Things IoT [6]. It is a cheap computer that runs the Linux operating system.
The Pet Care System can be set according to its feeding, bathing and cleaning schedules. This is done through programming the GPIO pins of the RPi are connected to the feed dispenser, feed catcher, blower and dryer units and the water pipes located at the lower part of the kennel. The Real-Time Clock (RTC) module was also included in the system to maintain the real date and time of the system. The feed container is to be filled with dry dog food that will last during the system operation. The amount of feeds to be dispensed is also included in the system. The feed catcher serves as the plate. The left over feeds is disposed before the bathing schedule to prevent the soaked feeds from mixing with the newly dispensed feeds. A water dispenser can be attached to the kennel for hydration purposes.
Thus, the need to design and develop a Dog Day Care Helper using the existing technology is a solution to the above-mentioned problem.

2.0 METHODOLOGY

The study is a developmental research using the prototyping technique. It is focused on the design, analysis and development of interfaces components for a Raspberry Pi dog Day Care Helper System.

2.1 Project Development Procedure

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The Project Development process has seven steps as shown in Figure 1. It highlights the steps that were undertaken during the project's progress. It started with the gathering of relevant literature and studies thru library and internet research. Materials and equipment needed for the construction of the design were prepared. Construction and testing ofthe hardware modules followed. The feeder was checked for accuracy and efficiency of feed disposal. The sprinkler was also checked for proportionate water distribution. The drain hose was also checked if it is overflowing, leaking or clogging. The next activity undertaken was the development of software, each program was tested for functionality. Once free of errors, integration of the hardware and software was accomplished.

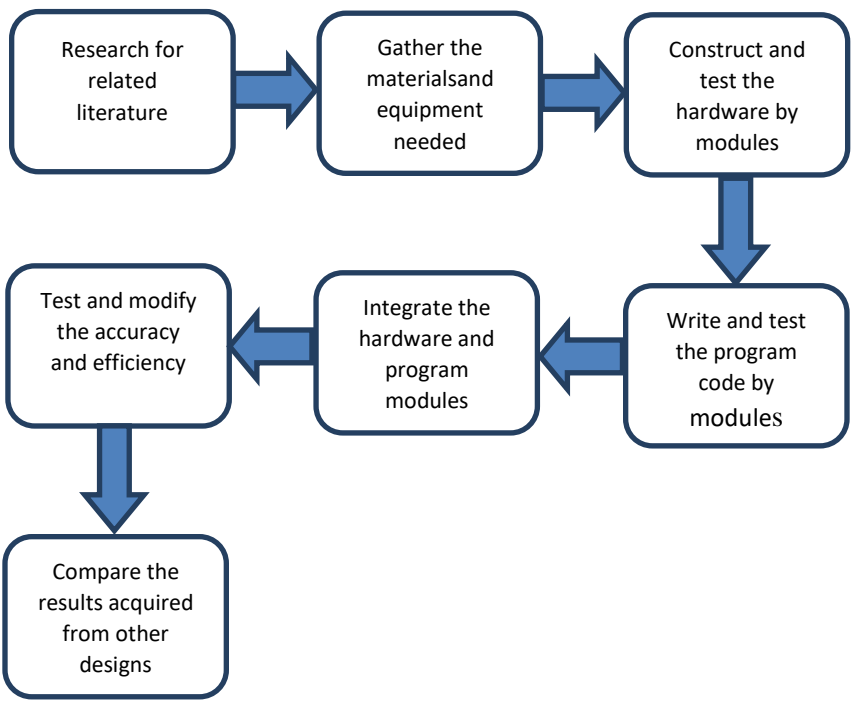

Figure 1: Project Development Procedure

2.2 Pet Care Design

More and more designs were developed to address pet care through feeding. The Pet Feeding System Using Raspberry Pi and Global Systems for Mobile Communications for UTeM Melaka, Malaysia [7] was designed to introduce one of the very applications of RPi and GSM that is to make an automatic pet feeder with flexible feeding time. It makes use of a pet food

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container with three division with cover that is controlled via text messaging. The study focuses on the compatibility of the RPi and GSM module by evaluating and analyzing their performances and not evaluating the hardware components of the pet feeder itself.

Mooser designed a prototype of the Automatic Home Feeder [8] to go off and release food and water at a predetermined time. He made use of a conditioning system via voice recording of the pet owner that will sound at the predetermined time to notify the pet that it's feeding time. The designer made use of a pair of solenoid valves reactive to a specific electrical signal to sequentially opening and closing each of the outlets.

Another similar design is the Raspberry Pi Dual Cat Feeder [9] which was intended to feed two cats daily while no one is around. It made use of servo motors controlled by RPi to manipulate the dispenser to release feeds. The objective of the design is to fill the container with cat food forseveral days consumption. The first version of the design is time-based. Later it was upgraded to be wifi-ready. The next improvement will be the inclusion of the pi camera for monitoring purposes.

A Microcontrolled - based Hog Feeding System [10] is a study conducted to determine the viability of providing hog feeds automatically.

Another concern of pet care is the observance of proper hygiene. A Self Cleaning Animal Kennel [11] was designed to take care of the animal waste. A solid sheet was laid along the floor of the kennel to collect animal waste. A sheet of absorbent paper is applied over the waste and deodorant is applied to the paper for some time. The side edges of the composite sheet are then folded inwardly and the composite sheet is rolled in coiled form to pack in the waste. The procedure is similar to the manual process in cleaning animal waste except that it made use of sensing devices to do so.

The Automatic Self-Cleaning Liter Box for Cats [12] is a patented sifting system that automatically separates waste from clean litter. It also self cleans after every use and reduce litter box odor. Multiple cats can use it as long as it is as light as 5 lbs. This is already available in the market.

The Portable Animal Bathing Apparatus [13] is made of a box-like structure that has a detachable top covering member and a network of perforated spray pipes. It has an extension pipe to attach the spray pipe network to a source of water supply and a drain outlet in the bottom for the disposal of the collected water. It has an opening to keep the animal head outside the box to feel comfortable and to allow the owner to do the caressing or to provide food during the bathing process to calm the pet. This design is not automated.

A dog bathing system called Dog-O-Matic [14] is a canine carwashvending machine except that the system is enclosed. The owner can see his pet via the glass door during the bathing and drying process.

The Study and Application of the IoT in Pet Systems [15] examines the capability of computation, communication and control technologies to improve human interaction with pets by the technology of the Internet of Things. It tackles the improvement through the pet application of the ability of location awareness and help the pet owners raise their pet on the activity and eating control easily.

The difference between the DDCH and other designs is shown in Table 1. The system hasa higher cost because of the availability of multiple functions. None in the market has these many features.

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Table 1: Comparison of the Dog Day Care Helper with Other Pet Care System

	Dog Day Care Helper Using Rpi	Pet Feeder Using Rpi with GSM [7]	Automatic Self litter Box [12]	Dog-O-Matic [14]
Cost	Higher	Lower	Lower	Higher
Power supply	Required	Required	Required	Required
Eating Schedule	Automatic	Via text message	Not supported	Not supported
Bathing	Automatic	Not supported	Not supported	Automatic
Blow-dry	Automatic	Not supported	Not supported	Automatic
Litter cleaning	During bath time	Not supported	Sifting	Not supported
Safety	Use Dog cage	none	none	none

2.3 Dog Day Care Helper

Figure 2 shows the block diagram of the Dog Day Care Helper System (DDCHS)using Raspberry Pi. RPi version 2.0 model B was used to serve as the main controller of the system. The raspiGPIO pins areconnected to feed dispenser, feed catcher, shower and blow dryer and the RTC module to send and/or receive signal.

The proposed system is composed of three modules such as the feeding module, shower module and blow-dry module as shown in Figure 3. They are all attached to a regular dog cage and the DDCHS controller. The litter catcher is inclined for easy disposal of the litter and the consumed water thru the hose-drain.

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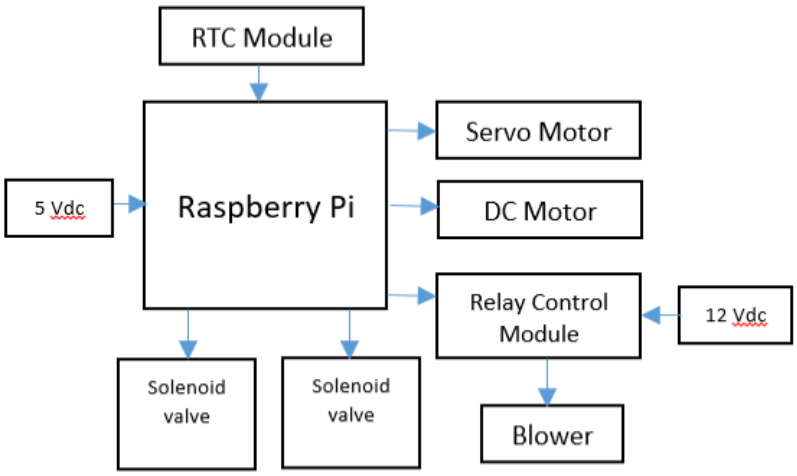

Figure 2: Block Diagram of the Dog Day Care Helper System

2.3.1 Feeding Module

One of the modules attached to the RPi is the feeding module. It is composed of the dry feeds dispenser and the feed catcher. The servo motor controls the opening of the feed dispenser which was initially set to the close state to prevent the feeds from freely falling. When the motor is triggered, the feed dispenser goes to the open state and releases the feeds. The amount of time and the opening size determines the amount of feeds dispensed. The feed catcher also called a "slider" is attached to a DC motor. It serves as underneath support to the food container that holds the falling feeds. This was set to open state. During bath time schedule, the DC motor is triggered, the feed catcher is sent into a closed state, thus slides back releasing leftover feeds to prevent the container from catching water from the shower hose.

2.3.2 Shower Module

The shower module is also connected to the rpi. It consists of the shower pipes that cover the entire cage with liquid soap/shampoo dispenser.The shower pipes are color-coded, the blue pipe dispenses pure water coming from the main source while the orange pipe dispenses diluted liquid soap/shampoo stored in a container. The pipes cover the entire cage to make sure that the dog will get wet. The solenoid valves control the flow of water from both pipes. Before the shower is activated, all the leftover feeds will be released. The process takes about 11 minutes. There are three stages of the bathing process, the first stage is the pre-rinse. This suppliesa small amount of water just to make sure the purr gets wet in preparation for the next stage. The second stage is called the soaping/shampooing stage where the valve releases the diluted liquid soap/shampoo, the valve is on for a pre-defined time. The last stage is the rinsing

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stage where enough supply of water is released to make sure that liquid soap/shampoo is rinsed off the purr.

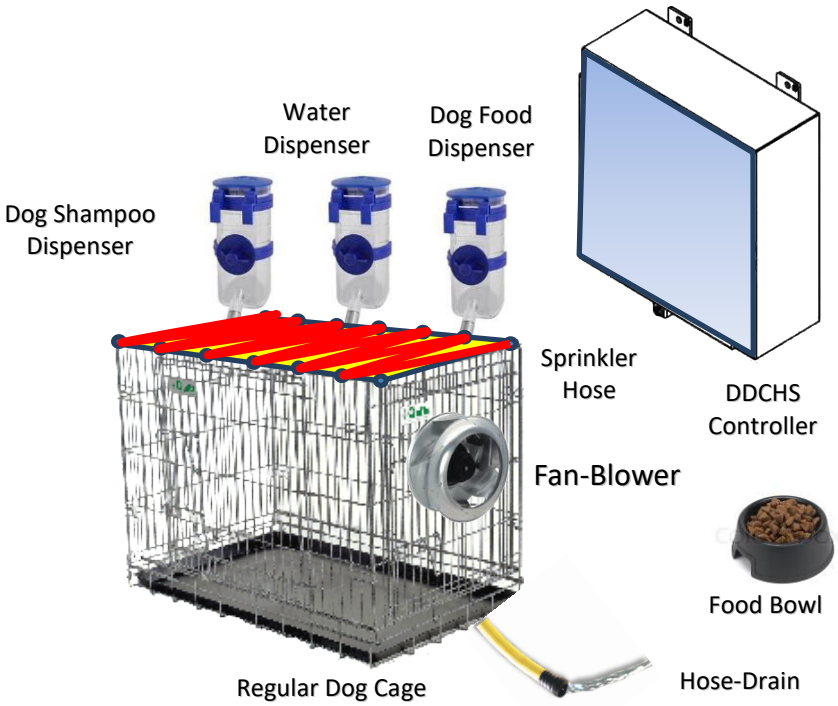

Figure 3: Dog Day Care Hopper

2.3.2 Blow Dry Module

Another component attached to the raspi is the blow dryer system connected to the relay. The relay power on the fan when triggered by the rpi. A fan was chosen as a dryer for safety purposes.It was set to the minimum.

2.3.3 Real-Time Clock Module

A real-time clock module is included in the proposed design to synchronize system date and time. The design is time-based. The GPIO pins of the RPiare triggered according to the time schedules of each activity. These pins will send a signal to the attached modules which in turn will activate or deactivate the corresponding circuit as shown in Figure 3. The system was developed using python programming language under the Linux platform using Jessie operating system. Programs were checked to syntactically and logically error-free. Program

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adjustment was made to ensure modules will function correctly, thus controlling motors and mechanism to regulate feed dispensing, to trigger the shower and then blow dry modules.

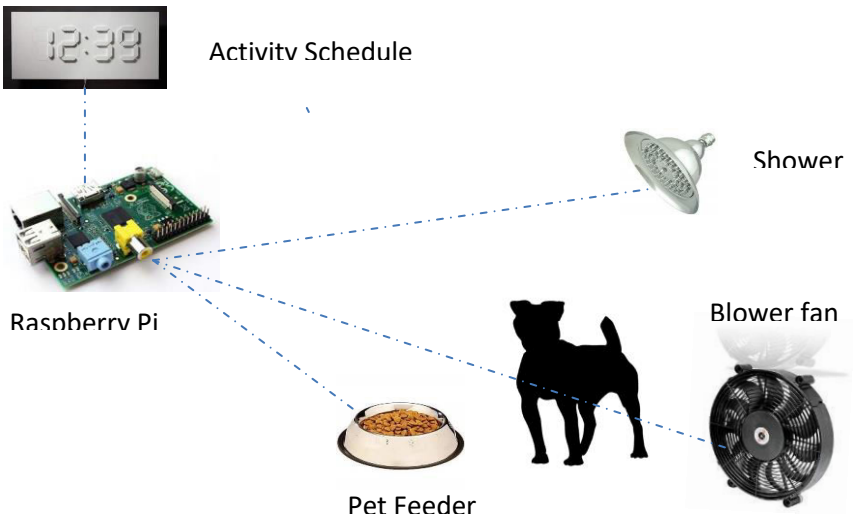

Figure 4: The diagram of the DDCH System

3.0 RESULTS AND DISCUSSION

Put, a femaleAsPin, was the subject of the experiment. The owner acquired Put as a gift. It was trained to stay inside the cage placed outside the house. It gets a chance to leave the cage duringthe weekend for bath time. It is towel dried. When the owner is at home, the dog is released from the cage to roam around the house freely or thearound community with a leash. It was fed with dry feeds twice a day, before the owner goes to work and when he arrived. That was the training of the pet.

The amount of dispensedfeeds was experimental. The owner started with three scoops and notice that the pet would eat up all the feeds. He started increasing the amount until he noticed that six scoops are enough leaving some leftovers. Put is brought to a family member of the owner in case he has to stay out for a day or two.

Put was eight months old when the system test started. The system will operate for three days to do the basic pet care, such as feeding and bathing. The test is on the accuracy of the quantity ofdispensed feeds given to Put. Figure 5 shows the percentage of the accuracy of the system in a four-day test of a three-day feeding. Overall, the system was proven 94% accurate in dispensing feeds. The system does not detect if the dog is not eating.

The system does not detect if the dog is feeling any discomfort in bathing or drying.

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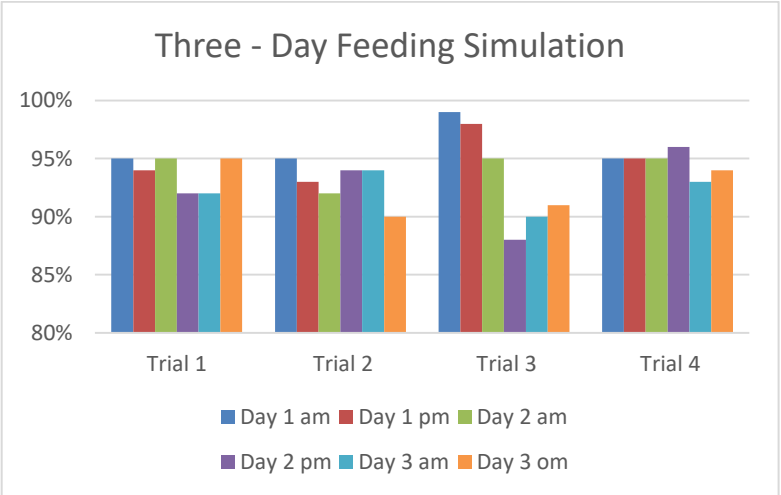

Figure 5:The experiment of three days feeding simulation

4.0 CONCLUSION

Automation has taken over mankind, it's only a matter of time where everything they need is just under their fingertips. The current trend of adopting technology and pet care compromises more innovative developments in pet management. The proposed system is considered an automated pet home, including pet feeder, bathing and blow- drying. The results of the study display advancement in the pet care system in raspberry pi technology.

The proposed systems have many rooms for improvement. Succeeding plans encompass the integration of other pet care devices such as sensors, webcam, 2 – way audio, led indicator. These will soon provide the various pet care demands of the pet owner. Soon, remote pet management can be realized.

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