Pet food dosing and dispenser design based on free technologies

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Abstract: - This paper merges mechatronics, programming and free hardware and software technologies tools. The design consists of a food container connected to a plate with a cover; allowing food to be eaten by the pet and can be dispensed according to user programmed parameters, which are based on age, race and weight of the animal. It consists of a weight sensor in the base plate, indicating when it is reached the required amount, cutting food supplies and in the next appropriate time places only the missing food on the plate. It also has a sensor in the food container for measuring the percentage of existing food and sending a text message to the phone numbers of registered users, as it reaches 20% of total capacity.

Key-Words: - Pet food, free technologies, free hardware, free software, feeding technologies.

1 Introduction

There are some works concerning the generation of food dispensers with a chute system, the dosing mechanism allows access to food on a wanted schedule for the pet [3], causing a bad food culture, which may result in becoming ill the pet, these problems are solved with the dosing and dispensing automatic food named “Perfect Petfeeder” which allows schedule programming, the amount of food to be dispensed and beeps when the food is in the reservoir it is running low [7], noting that this project has solved the main problems encountered in the first mentioned, but there is no mechanism to control the amount of food in the plate if the pet has not finished the first amount, only dosing in order to complete the missing amount, also the warning signal to the pet owner is not efficient if is not in place.

Taking in consideration these observations, a prototype which joins mechanics, electronic and web programming, using hardware and software free technology is presented with the following benefits:

- Do not have a dependency on a licensing or particular provider.
- There is an immediate correction of errors thanks to community service worldwide.
- Low cost, removing barriers in the budget.
- Can be modified, adapted and efficiently complemented each of the prototype components, due to have access to the source code and manage a modular architecture development.

The pet food dosing and dispenser based on free technologies for educating the pets has the following objectives:

1. Use free technologies like Arduino (free hardware) and C, PHP, HTML, CSS and JavaScript (free software).
2. Perform Arduino programming of the elements involved in the dispenser.
3. Perform programming synchronization according to use mode.
4. Perform construction and assembly of the dispenser with the appropriate materials.
5. Perform management environment programming for the entry of parameters.

6. Perform communication between the Arduino board and the web environment for sending alerts through SMS (Short Messenger Service).

2 Pet food dispenser prototype design

The research was initially conducted to determine the necessary theoretical basis for the construction of the project, and fulfill the objectives, having in mind that the project is essentially experimental and is based on building a prototype.

The methodology used is based on:

1. Study and identification of the problem: an analysis of the needs or characteristics of the problem is made, the existing researches that contributes or tend to solve the given problem is studied.

2. Determination of requirements: Focuses to identify each of the functional and nonfunctional requirements existing in the problem to be solved.

3. Cost-benefit analysis: This consists of analyzing the different alternatives, selecting which present greater economic and social benefits, which contribute to solving the stated problem.

4. Design and development of the solution: includes the preparation of designs and sketches of the solution, also the development and implementation of various planned activities.

2.1 Materials and equipment used

To make the project, some materials described next are used:

1. **Programmable Arduino Mega:** A high-speed micro controller that allows multiple connections to other devices [6].

   Arduino is a hardware and software fre platform, based on a simple plate with analog and digital inputs and outputs, using “Processing” as development environment programming language, i.e., an open source platform for electronic prototypes code.

   Being open source, it makes that its design and distribution, may be used freely for the development of any project without license [1].

Figure 1. Arduino Mega 2560
Source: [10]

2. **Servomotor HS-311 for 3 Kg:** Allows driving motors with diverse grades and it is handled with PWM in microcontrollers.

   A Servomotor is a small device that has an axis of controlled performance. This can be brought to specific angular positions by sending a coded signal. When this coded signal is in the input line, the servo will maintain the angular position of the gear. When the coded signal changes, the angular position of the sprockets changes.

   In practice, servomotors are used to position control surfaces as movement of levers, small elevators and rudders. They are also used in radio controlled puppets and robots [9].

Figure 2. Servomotor
Source: [9]

3. Protoboard: A plate with holes that allows to insert electronic components and wires to build circuits [5].

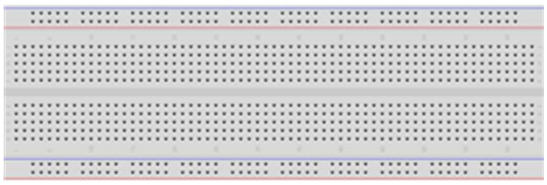

Figure 3. Protoboard
Source: [5]

4. Weight sensor HX711 for 3 KG: It's a weight sensor which sends transformed values to be recognized by the Arduino [2].

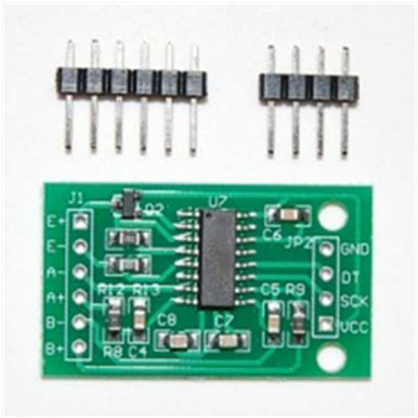

Figure 4. Weight sensor
Source: [2]

5. Ultrasonic transducer HC-SR04: An ultra-sonic distance sensor to be used for measuring distance with the Arduino plate [4].

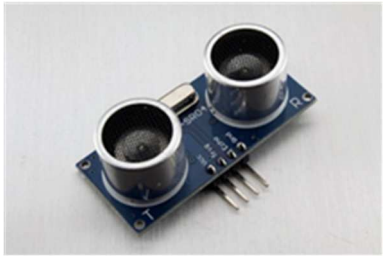

Figure 5. Ultrasonic transducer
Source: [4]

6. RTC (real time clock) DS1307 for Arduino: The DS1307 RTC is a real time clock with I2C communication. Once loaded the initial date, allows obtaining the current date automatically, the DS1307 is a circuit that detects when the power is down and automatically switches to use a battery, this module also has a AT24c32 memory to store a larger amount of data [8].

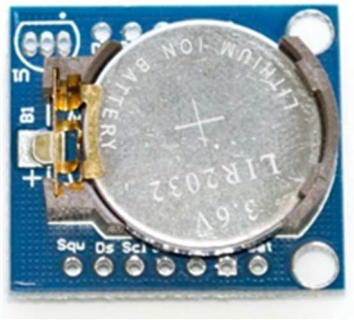

Figure 6. Real time clock
Source: [8]

7. Connecting cables for Arduino: Connects the sensors with the micro controller, as with the protoboard if required and power source and ground required for proper operation.

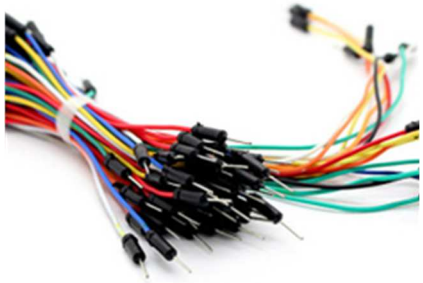

Figure 7. Connecting cables
Source: [11]

2.2 Prototype development

Development process:

1. Conduct an investigation of how Arduino and libraries works.
2. Analyze cost-benefits in materials selections.
3. Run the verification of libraries with test of materials.
4. Develop unitary running tests.
5. Build the model and install the components.

6. Proceed with the assembly of the elements involved in the prototype on a solid base for the operation.

The prototype starts with the entry of data relating to: feeding schedules, race, weight and age of the pet. Based on this information the amount of food is assigned on schedule and available time given by the user, if the quantity of food is less than 20% of total capacity in the container, a text message (SMS) is sent to phone numbers registered by the user.

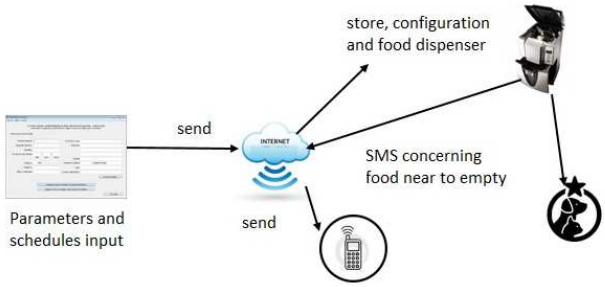

Figure 8. Flow communication between the various technologies involved in the prototype.
Source: Own preparation

Construction of the prototype:

In Figure 9 can be seen a diagram of the prototype implementation done, which has the following components:

Figure 9. Implementation Scheme of the prototype.
Source: Own preparation

• Integrated circuit: A programmable Arduino Mega microcontroller, which integrate and communicate the various existing components in the prototype, has all the programming logic to run efficiently automated actions as the followings:

- Schedule management through a DS1307 real-time clock, which allows to control the times at which the food dosing will be held and time available in which the food will have to be consumed by the pet.
- Measuring of minimum amount of food for sending alerts, this measurement is performed by an ultrasonic sensor which analyzes according to the distance if there is enough food in the container, generating a signal to integrated circuit for performing notification actions.

• Food Container: This is a container in which the pet's food is placed, it contains a sensor located at a desired point that can emit a signal if the food has less than the 20% of the container capacity.

• Alarm: Aims to be activated once the food sensor has issued a pulse to the integrated circuit, indicating that the food is running out, this is done using the Arduino Ethernet port to communicate with a REST JSONP Web service for Sending a SMS (text message) to the telephone numbers of the registered users.

• food plate: It aims to contain the dose of pet food, which has a weight sensor on its base, which is steady communicates with integrated circuit to inform if the dose is completed, allowing always serve the appropriate amount of the pet's food.

• Food Cover: It is controlled by the integrated circuit with the use of real-time clock DS1307 that drives the servomotor HS-311 in order to open the cover plate so the pet can eat and closes when it has fulfilled the time set by the administrator to ingest food. This is done for educating the pet about the time for eating.

3 Conclusions

The development of the pet food dosing and dispenser with notifications alert has been proposed for generating a better feeding culture of the animals and keep track of the nutritional status of them.

The generation of this kind of projects with the free software and hardware used can maintain better communication between the various existing components, also providing an advantage in cost-benefit ratio when purchasing only the necessary

items and have extensive information for the use them.

It's recommended improving the design and use of materials for a obtaining a product with higher quality, image that can be patented and commercialized.

Acknowledgment: Authors want to thanks the support given to this project by the Secretaría de Educación Superior, Ciencia, Tecnología e Innovación of Ecuador and Prometeo Program.

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