doi.org/10.51891/rease.v8i11.7792

FEEDING SYSTEM FOR DOMESTIC ANIMALS USING AN OPEN-SOURCE ELECTRONIC PROTOTYPE PLATFORM

SISTEMA DE ALIMENTAÇÃO PARA ANIMAIS DOMÉSTICOS UTILIZANDO UMA PLATAFORMA DE PROTÓTIPO ELETRÔNICO DE CÓDIGO ABERTO

SISTEMA DE ALIMENTACIÓN PARA ANIMALES DOMÉSTICOS UTILIZANDO UNA PLATAFORMA PROTOTIPO ELECTRÓNICA DE CÓDIGO ABIERTO

Felipe Lima dos Santos[1]
Rodrigo Jeremias dos Santos[2]

ABSTRACT: This article sought to present a study of an automatic feeder for domestic animals in cases of absence of the owner, serving water and feed, using an open-source software and hardware electronic prototyping platform, that is, without any obstacle related to patents and generally relatively low cost. The motivation for this work is due to the fact that we are looking for a low-cost open-source solution for an efficient system with functions to guarantee the ability to control and monitor this feeding, being an essential security method and can be used for every domestic pet. The methodology consists of approaching the functions of each component of this system and their integration, resulting in a demonstration by simulation with the assembly of the project, executing the feeding of food and water as planned. It concludes with the demonstration that the project is feasible, making it an incipient solution for others, such as feeding systems for larger animals, using appropriate programs and components.

Keywords: Arduino. Control. Feeding.

RESUMO: Este artigo buscou apresentar um estudo de um comedouro automático para animais domésticos em casos de ausência do proprietário, servindo água e ração, utilizando uma plataforma de prototipagem eletrônica de software e hardware de código aberto, ou seja, sem qualquer obstáculo relacionado a patentes e geralmente de custo relativamente baixo. A motivação para este trabalho deve-se ao fato de se buscar uma solução open-source de baixo custo para um sistema eficiente com funções que garantam a capacidade de controlar e monitorar esta alimentação, sendo um método de segurança essencial e que pode ser utilizado para cada animal doméstico. A metodologia consiste em abordar as funções de cada componente desse sistema e sua integração, resultando em uma demonstração por simulação com a montagem do projeto, executando o fornecimento de ração e água conforme planejado. Conclui-se, com demonstração, que o projeto é viável, tornando-se uma solução incipiente para outros, como sistemas de alimentação para animais de maior porte, utilizando programas e componentes adequados.

Palavras-chave: Arduino. Controle. Alimentação.

[1] Graduação em Engenharia Elétrica com Ênfase em Sistemas Eletrônica. Universidade do Estado do Rio de Janeiro.
[2] Graduação em Engenharia Elétrica com Ênfase em Sistemas Eletrônica. Universidade do Estado do Rio de Janeiro.

RESUMEN: Este artículo buscó presentar un estudio de un sistema de cerradura electrónica con contraseña utilizando una plataforma de prototipado electrónico de software y hardware de código abierto, es decir, sin ningún obstáculo relacionado con las patentes y, en general, con un costo relativamente bajo. La motivación de este trabajo se debe a que buscamos una solución de código abierto de bajo costo para un sistema de control de acceso eficiente, un sistema con funciones para garantizar la capacidad de controlar, monitorear y restringir el movimiento de personas, siendo un método de seguridad esencial que se puede utilizar en cualquier lugar. La metodología consiste en abordar las funciones de cada componente de este sistema y su integración, dando como resultado una demostración por simulación con el montaje del proyecto, ejecutando la apertura y el cierre según lo previsto. Se concluye con la demostración de que el proyecto es factible, convirtiéndolo en una solución incipiente para otros, como sistemas seguros robustos o cambio de contraseña predefinida para acceso biométrico, utilizando programas y componentes adecuados.

Palabras clave: Arduino. Control. Alimentación.

INTRODUCTION

The relationship between animals and man dates to prehistoric times, when animals were used to protect the territory where man lived, helping with hunting, and transporting cargo and humans (CAETANO, 2010). Man has always depended on interactions with other species for his survival, and this relationship a priori was predation, moving later to domestication (HART, 1985). Due to the coexistence of the Members with animals, it is understood that in their day-to-day life the animals spend a good part of their time alone, without feeding or overfeeding. And knowing that a percentage of 20% of excessive weight, the predisposition to serious health problems is high (VCAHOSPITALS, 2022), it is important to pay attention to the issue of food, because the nutritional status influences the quality of life of the animals. There is concern regarding the link between nutrition and health and its contribution to the overall well-being of animals. Domesticated animals are completely dependent on their owners for food.

This article aims to present a study of an automatic feeder, which is useful in feeding domestic animals in cases of absence of the owner, serving water and feed automatically. The user enters the times that the animal will be fed, and the system fills the storage reservoirs. To avoid obstacles related to patents, an electronic prototyping platform called Arduino is used as a control element. The Arduino is a microcontroller and some other electronic components mounted on a small printed circuit board with a serial interface for communication with a standard computer. On this board there are also some connectors where other external circuits can be connected, such as sensors, LEDs, switches, relays, and small motors (SILVEIRA 2011).

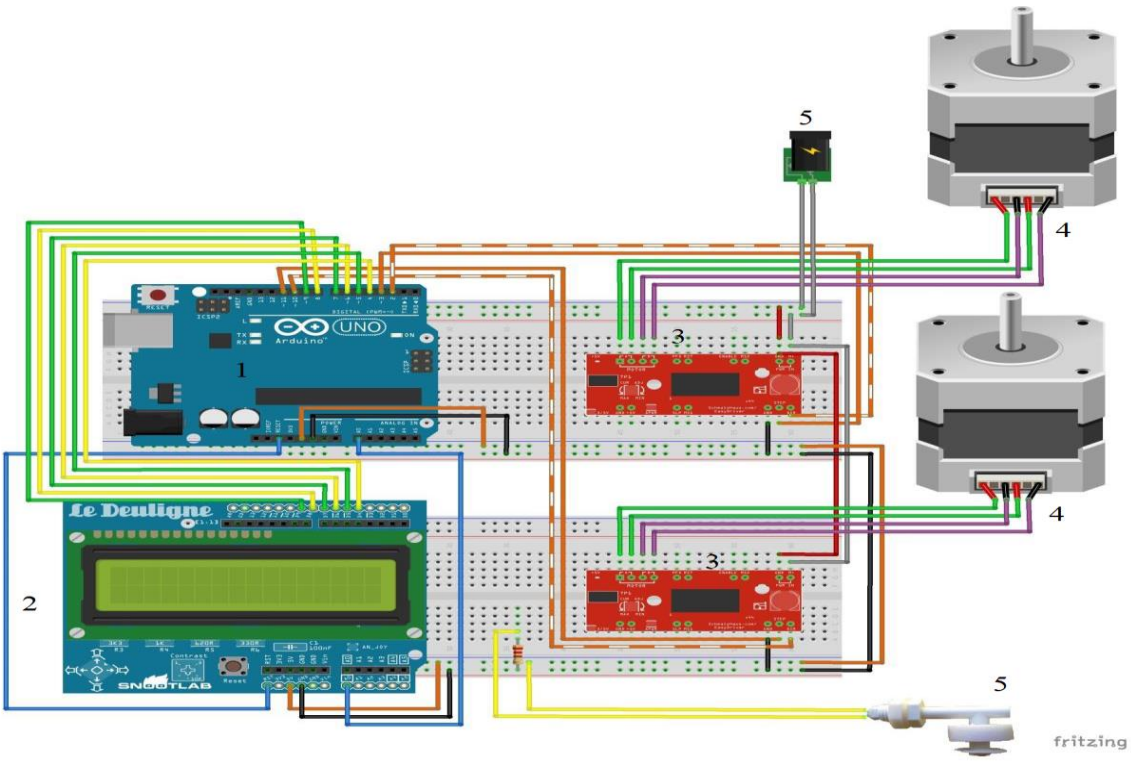
In addition, all its data, from programs to schematics, are available on its website for free and forums were created for discussions about it (QUEIROZ, SOUSA, 2018).

METHODS

For the construction of the project, components that perform certain functions in the system are required and must be fully integrated with the programming. Figure 1 shows the representation of how these components interact and their characteristics are detailed in sequence.

The main controller of the system is the Arduino, which consists of a microcontroller circuit board for the development of electronic prototypes, which allows the recording of a set of instructions through a programming language in order to minimize complexities (FRIZZARIN, 2016). To use the programming language to create programs and record them on the board, it is necessary to use a development environment that supports this language and perform the necessary steps to compile and record it through an interface between the computer and the platform.

Figure 1 – System Representation using Friting



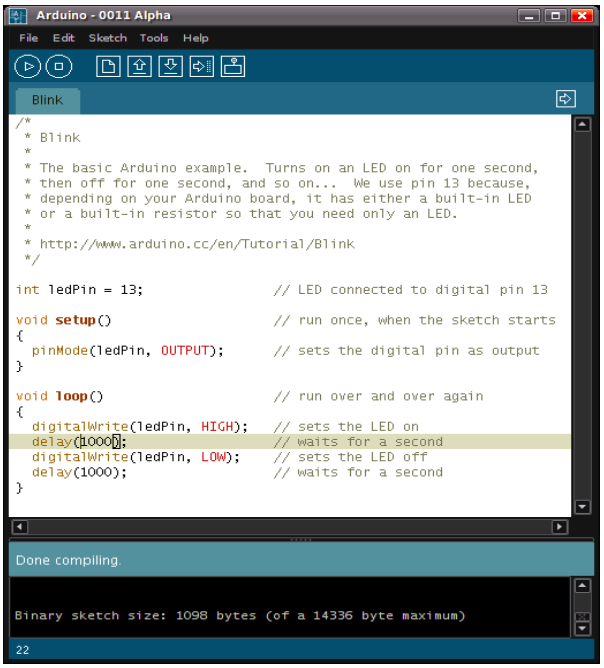
Legend: 1 – Arduino Uno, 2 – LCD, 3 – Stepper Motor, 4 – LEDs, 5 – Level Sensor, 6 – Power Supply

Source: SANTOS RJ, 2022.

To develop instructions and record them on the Arduino platform, an Integrated Development Environment - IDE must be used (QUEIROZ, SOUSA, 2018). It has a text editor that accepts the instructions and checks for syntax errors, a compiler to generate the file and a loader to send it to the platform. Figure 2 shows the IDE, which, through a microcomputer, has its programming transferred to the platform.

Another interesting factor is the use of libraries, which consist of a set of instructions developed to perform specific tasks related to a given device. The libraries have functions specifically designed to perform tasks such as setting the accelerometer, reading acceleration, gyroscope, temperature data, etc. and its use facilitates development, making the code simpler and more organized (MONK, 2010).

Figure 2 – Illustration of the Arduino Integrated Development Environment.



Source: QUEIROZ, SOUSA, 2018.

The LCD display (Liquid Crystal Display) is responsible for displaying messages to the user. It is considered a visual interface for the user and has a specific library that facilitates its interface with the controller. This LCD display has 16 columns and 2 lines, with blue backlight and white lettering.

The communication module used I2C, specific to Arduino. The I2C module is used to communicate the alphanumeric LCD with the microcontroller, with this, it is possible to communicate the microcontroller with the alphanumeric LCD display using only the SCA and SCL pins. To connect the LCD display directly to the Arduino, six microcontroller pins are needed, with this module only two are needed (SMARTKITS, 2022).

For the operation of the stepper motors, a driver is necessary to supply the coils sequentially. This driver can go from the simplest one, for cases where the motor rotation is done in full or half steps, or more complex, for cases where you want to have even more steps between one coil and another. In this work, Easy Driver was used, which is an integrated circuit that already contains the necessary driver to control the motor. The Arduino cannot be connected directly to stepper motors, as each output port only supports 40 mA of current, and the motor coil needs a higher value for proper operation. The Arduino output is connected to the driver, and this is connected

directly to the motor, functioning as a power interface between the two. A great advantage when using Easy Driver is that only two Arduino output ports are needed for operation, being necessary to inform only the direction of movement and the desired number of steps, and the driver sequentially feeds the coils for rotation. from the engine.

A stepper motor, also known as step motor or stepping motor, is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is correctly sized to the application in respect to torque and speed (WIKIPEDIA, 2022).

A level sensor is a device that is designed to monitor, maintain, and measure liquid (and sometimes solid) levels. Once the liquid level is detected, the sensor converts the perceived data into an electric signal. Level sensors are used primarily in the manufacturing and automotive industries, but they can be found in many household appliances as well, such as ice makers in refrigerators (FIERCE, 2022).

The power supply is a component of electronic devices that serves to transform the electrical energy that arrives through the outlets into a continuous electrical current. That is, it receives energy at 110V or 220V and transforms it into the appropriate voltage for the device to work, which is usually 12V. Some sources can raise or lower the voltage level, and there are also those that only isolate the circuit from the power grid. It is still an important protector against power surges and instability, very common in Brazil (ILUMINIM, 2022). Each type of equipment will require a specific source. For this project, it is used to supply easy drive.

With the components defined, the idea of how the system works is summarized as follows:

1. For solid food, the system starts with the interaction between the user and the equipment, where it is necessary to enter information for the sequence of its operation. The user must choose whether he wants feed to be distributed twice or three times a day.
2. Then the user must inform the times at which he wants the device to provide food.
3. From this point on, no more information is needed, just having to check if the feed tank is full for the correct operation of the device. The display is always on showing the clock.
4. The water supply is done automatically through a sensor. The system identifies when the level of the container is empty and thus, without having to adjust any time or other information, the water is supplied.
5. Upon reaching the low level, the contact is closed, and a signal is sent to the Arduino. The stepper motor is turned on causing the water mechanism to be opened during the necessary time to completely fill the container. After this time, the stepper motor is turned on again to close the mechanism, thus ending the process.

RESULTS AND DISCUSSIONS

It is possible to obtain the results with the assembly of a system, simulating the operation of the access control with the described components, displaying on the LCD display the messages to enter how many times solid food will be given per day and the times. Figure 3 displays this project prototype.

Figure 3 – Project Prototype.

Source: SANTOS RJ, 2022.

Analyzing the results and figures, it is possible to observe the basic construction of a system for simple feeding control using free software and hardware equipment. The ease of use and availability of a quality microcontroller also made a notable contribution. Obviously, improvements can be applied, for example, the introduction of other input interfaces, like buzzers to call the pet´s attention. The application of this study can be extended, serving as a basis for several other systems, such as bigger projects for larger animals, depending on the programming performed in its control software and inclusion of appropriate sensors and actuators, with potentially reduced costs using open-source tools.

CONCLUSION

When observing a feeding system, its importance, and the different ways in which it can be built is remarkable. The use of an open-source technology can make the construction of the main component more practical and low-cost since there is no involvement with patents in this type of tool. The objective of this article is reached, due to the exhibition of the study of an automatic feeding system for domestic animals with this technology, simulating the supply of food and water. Regarding the result obtained with the demonstration, it is concluded that the project is feasible, making it an incipient solution for others, such as robust systems for larger animals, using programming and suitable components.

REFERENCES

CAETANO ECS. As contribuições da TAA- Terapia Assistida por Animais à Psicologia. Universidade do Extremo Sul Catarinense- UNESC, Criciúma, 2010.

FIERCE. 2022. What is a level sensor. Disponível em: https://www.fierceelectronics.com/sensors/what-a-level-sensor. Acesso em: 20 nov.2022.FRIZZARIN FB. Arduino: Guia para colocar suas ideias em prática. São Paulo: CASA DO CÓDIGO, 2016; 255p.

HART BL. The behaviour of Domestic Animals. New York: W.H Freeman and Company, 1985.

ILUMINIM. 2022. Fonte de alimentação o que é e para que serve. Disponível em: https://blog.iluminim.com.br/fonte-de-alimentacao-o-que-e-e-para-que-serve/. Acesso em: 20 nov. 2022.

MONK S. Fritzing for Inventors: Take Your Electronics Project from Prototype to Product. Editora: McGraw-Hill Education Tab, 2015; 240p.

QUEIROZ WRO, SOUSA WQ. A importância da plataforma arduino no meio acadêmico. Revista Científica Multidisciplinar Núcleo do Conhecimento. Ano 03, Ed. 08, Vol. 12, pp. 123-133, 2018. ISSN: 2448-0959.

SMARTKITS. 2022. Modulo Serial I2c. Disponível em: https://www.smartkits.com.br/modulo-serial-i2c-para-displays-lcd. Acesso em: 20 nov. 2022.

SILVEIRA JA. Experimentos com o Arduino. 1. ed. Editora Ensino Profissional, 2011; 242p.

VCAHOSPITALS. 2022. Obesity in dogs. Disponível em: https://vcahospitals.com/know-your-pet/obesity-in-dogs. Acesso em: 20 nov.2022.

WIKIPEDIA. 2022. Stepper Motor. Disponível em: https://en.wikipedia.org/wiki/Stepper_motor. Acesso em: 20 nov.2022.