

Barcode system applied to medical prescriptions

Sistema de código de barras aplicado a recetas médicas

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DOI: 10.35429/EJDRC.2023.17.9.27.31

Received June 10, 2023; Accepted December 10, 2023

Abstract

In this paper the results and methodology for development of a barcode system applied to health sector are showing. The project main objective is generating medical prescriptions with a barcode to make the medicine identification assigned by the specialist easier and optimize the issuance process for the patient. It is necessary to access a database of basic plan medications to generate the physical document of the medical prescription. The previous information as a first project stage, considering to the future linking this system to automatic medicine dispenser devices install in different spaces into health institutions and public areas and thus, reduce the waiting times and avoid the spaces saturation for expand the access to these services to entire population.

Resumen

En el presente trabajo se muestran los resultados obtenidos y la metodología aplicada para el desarrollo de un sistema de lectura de códigos de barra con un enfoque de aplicación al sector salud. El objetivo de este proyecto es la generación de recetas médicas con su respectivo código de barras para facilitar la identificación del medicamento adscrito por el especialista y agilizar el proceso de expedición del mismo para el paciente. La metodología a emplear para su desarrollo se divide en tres fases: diseño de la plantilla de la receta médica, sistema para la lectura y procesamiento de datos, así como la visualización de la información al usuario; siendo necesario acceder a una base de datos correspondiente a los medicamentos del cuadro básico para generar el documento físico de la receta médica. Lo anterior como una primera etapa del proyecto, considerando a futuro vincular este sistema a un dispositivo capaz de actuar como un despachador automático de medicamentos instalado en diferentes puntos de las instituciones de salud o espacios públicos y así, lograr reducir los tiempos de espera, evitar la saturación de estos espacios y ampliar el acceso a los servicios de salud a toda la población.

System, Barcode, Medical prescription

Sistema, Código de barras, Receta médica

Citation: JARA-RUIZ, Ricardo, QUEZADA-MUÑOZ, Marcos Emmanuel, DELGADO-GUERRERO, Sergio Humberto and GARCÍA-RODRÍGUEZ, Juan Carlos. Barcode system applied to medical prescriptions. ECORFAN Journal-Democratic Republic of Congo. 2023, 9-17: 27-31

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Introduction

In recent decades, the healthcare sector and technology have achieved a synergy and a transcendental impact in terms of advances in the diagnosis and treatment of diseases to the point of achieving a dependence that has enabled great challenges to be overcome. It is clear that the Internet of Medical Things (IoMT) (also called the Internet of Health Things) is a clear trend in this sector called "Smart Healthcare", as the technology to create a digitised healthcare system that connects available medical resources and healthcare services considered an application of IoT for medical and health-related purposes, data collection and analysis for research and monitoring [1].

Thus, complementing the IoMT has been the implementation of barcode technology that typically appears on product labels, but also appears on patient identification wristbands in hospitals and in almost any context where a person or object needs to be verified in and out of any kind of inventory system [2]. For example, in [3], a system is developed to improve patient care processes by integrating barcode assignment to avoid errors in medication administration. However, in some countries, including Mexico, the tools used in patient care services have lagged behind in terms of technology, resulting in inefficient processes and waiting times and being overwhelmed by the number of users. Therefore, implementing a system that integrates barcode technology in medical prescriptions will make it possible to address areas of opportunity in order to improve and expand access to services in this sector.

Methodology

This first stage of the project focused on the development of the barcode reading system, divided into three phases: design of the medical prescription template, the system for reading and processing data, and the display of information to the user.

The following is a description of the phases corresponding to the development of the project.

First phase. Design of the template

For the development of the first phase, the medical prescription template (Figure 1) is generated using a format in the Excel programme. The design is based on the basic recommended elements that a medical prescription should comply with, as established by the health agencies of the Mexican government [4].

The basic recommended elements are listed below:

- Referring to the patient:
 - a) Full name.
 - b) Age.
 - c) Medical diagnosis.
 - d) Treatment.
 - e) Generic name of the medicinal product.
 - f) Dosage.
 - g) Presentation.
 - h) Frequency
 - i) Duration of treatment.
 - j) Indications.
- Concerning the prescribing physician:
 - a) Full name of the prescribing physician.
 - b) Professional registration number.
 - c) Institution issuing the qualification.
 - d) Date.
 - e) Full address of the practice.
 - f) Signature of the doctor.

Figure 1 Prescription template with security features
Source: Own elaboration [Excel]

In addition to the basic elements, electronic security elements such as the electronic seal to validate and guarantee its authenticity and the barcode for the identification of the medicinal products are integrated in the lower part of the format.

Second phase. System for reading and processing data

Subsequently, the programming of the reading system is developed, which integrates an electronic laser device or scanner (Figure 2) connected to the Arduino platform via the USB Host 2.0 Shield module (Figure 3) for data acquisition and subsequent processing when compared with a local database, which contains the information related to the medicines in the basic list for their identification.



Figure 2 Barcode scanner.
Source: [5]



Figure 3 Usb host shield module.
Source: [6]

Third phase

Display of information to the user.

In this stage, a summary of the information corresponding to the medicines indicated by the specialist for dispensing is displayed to the user by means of an interface.

Results

This section shows the results obtained from the development of the first stage of the project corresponding to the barcode reading system. For this purpose, two representative examples of medical prescriptions with symbolic information on patients and their diagnosis are shown.

Figure 4 shows the medical prescription generated for a first patient who is prescribed three different medicines to treat his diagnosis, and Figure 5 shows how the system works, as when the barcode is read, it shows that it identifies correctly as the information coincides with what is indicated in the medicines section of the medical prescription. Figure 6 and 7 show the results for a second patient.

However, these results are necessary to link the electronic seal to the corresponding health institution to validate and guarantee the authenticity of the prescription generated and indispensable to link with the second stage, which consists of the development of the medicine dispensing device.



Figure 4 Example 1 - Medical prescription with information and safety features
Source: Own Elaboration [Excel]

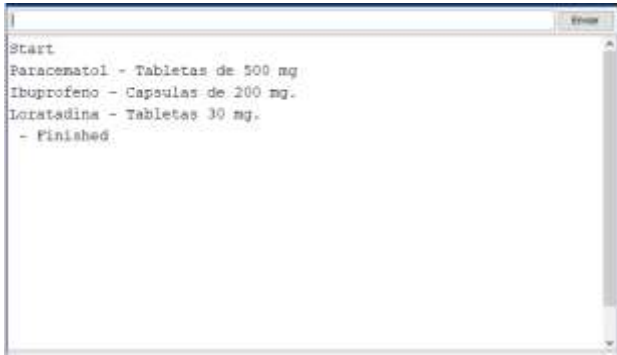


Figure 5 Result of the identification of medicines in example 1

Source: Own Elaboration [Arduino]



Figure 6 Example 2 - Medical prescription with information and safety features.

Source: Own Elaboration [Excel]

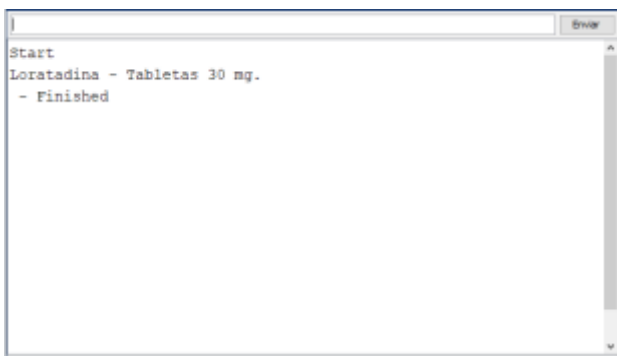


Figure 7 Result of the identification of medicines in example 2

Source: Own Elaboration [Arduino].

Conclusions

With the analysis of the results obtained, significant progress has been made in the development of the project, since by fulfilling the objective of including an electronic identifier in medical prescriptions, the first stage has been completed, enabling the system created to identify the information more quickly and efficiently.

In addition, the aim is to continue improving its operation by validating and linking the electronic seal to health institutions and to have access to more extensive databases of medicines in order to continue with the next stage.

We are aware that health services and technology are closely related and there are areas of opportunity in patient care services; with the development of this type of technology and tools we seek to have a significant impact on the care process and ensure that the patient receives the right medicines in the shortest possible time, as well as expanding access to spaces by interconnecting medical resources and health services through the implementation of IoMT.

References

[1] Vasil Teigens, P. S. (2020). *Inteligencia artificial: la cuarta revolución industrial*. Cambridge Stanford Books.

[2] Núñez Ramos, A. (2005). *Análisis y diseño de sistemas*. México.: Pearson Educación.

[3] Judith Young, M. S. (2010). Bar Code Technology and Medication Administration Error. *Journal of Patient Safety*, 115–120. Obtenido de <https://www.jstor.org/stable/26632769>. DOI:10.1097/PTS.0b013e3181de35f7.

[4] Gobierno de México. (01 de junio de 2023). *Comisión Nacional de Arbitraje Médico (CONAMED)*. Obtenido de <https://www.gob.mx/conamed/articulos/elementos-basicos-de-una-receta-medica?idiom=es>

[5] Amazon. (1 de Junio de 2023). Obtenido de https://www.amazon.com.mx/Inateck-Barcode-Scanne-BCST-70-Gris/dp/B074M6RTM3/ref=asc_df_B074M6RTM3/?tag=gledskshopmx-20&linkCode=df0&hvadid=329541932554&hvpos=&hvnetw=g&hvrnd=6390800551644581298&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmld=&hvlocint=&hvlocphy=

[6] Tresdprinttech. (1 de junio de 2023). Obtenido de <https://tresdprinttech.com/mx/shield-para-arduino/40-usb-host-shield-20-7503040290064.html>