

Smart Medicine Box

Abstract

With the increase of aging population and chronic diseases, the problem of medication adherence is becoming increasingly prominent. As an emerging medical device, the smart medicine box aims to address this challenge by integrating advanced sensor technology, mobile applications, and cloud-based data management. This article introduces an Arduino-based smart medicine box system, which integrates slot sorting and automatic dispensing functions, and achieves smart medication management by using Arduino controller and blinker mobile application. The slot sorting technology can automatically identify and distribute multiple drugs, while the automatic dispensing function ensures that the drugs are delivered on time. Users can set medication time, type, and quantity through the Blinker application to achieve personalized medication management. The system has a user-friendly interface, supports multi-user operations, and can communicate with the medicine box through Bluetooth connection. The intelligent medicine box not only improves medication compliance, but also reduces human errors, and is suitable for patients who need long-term medication management.

Keywords: Slot sorting; Automatic dispensing; Arduino; Blinker Introduction

I. Research Background

The smart medicine box is a product that combines modern technology with the functions of a traditional medicine box, aiming to help users take medication on time and improve medication adherence. With the acceleration of life pace, people are busy with work and often forget to take medicine. The emergence of the smart medicine box can remind users to take medicine, which has a significant impact on the recovery and physical rehabilitation of patients. The box is based on a smartphone app to monitor medication time in real time, synchronize medication data, and automatically generate medication health management records. The product integrates intelligence, simplicity, and practicality, regulating the timing and frequency of medication to help middle-aged and elderly people develop good medication habits. The development of smart medicine box is mainly based on the trend of population aging. The elderly population suffers from a large number of chronic diseases and needs to take multiple medications for long-term control and maintenance of disease stability. Due to the decline in physical function and memory of the elderly, the dosage and timing of medication often become a problem for the elderly and their caregivers. Therefore, designing a smart medicine box that can remind and assist the elderly every day through simple settings has very important research value and significance. The significance of the development of the smart medicine box lies in the establishment of a fully digital development solution to help the elderly use the smart medicine box through structural innovation and functional integration. The box achieves accurate control over medication time, type, and dosage, effectively avoiding the elderly from forgetting, making mistakes, or missing medication. It has good intelligence and user-friendly design, effectively solving the medication problems faced by the elderly due to visual or hearing impairments or communication difficulties.

I. Design plan

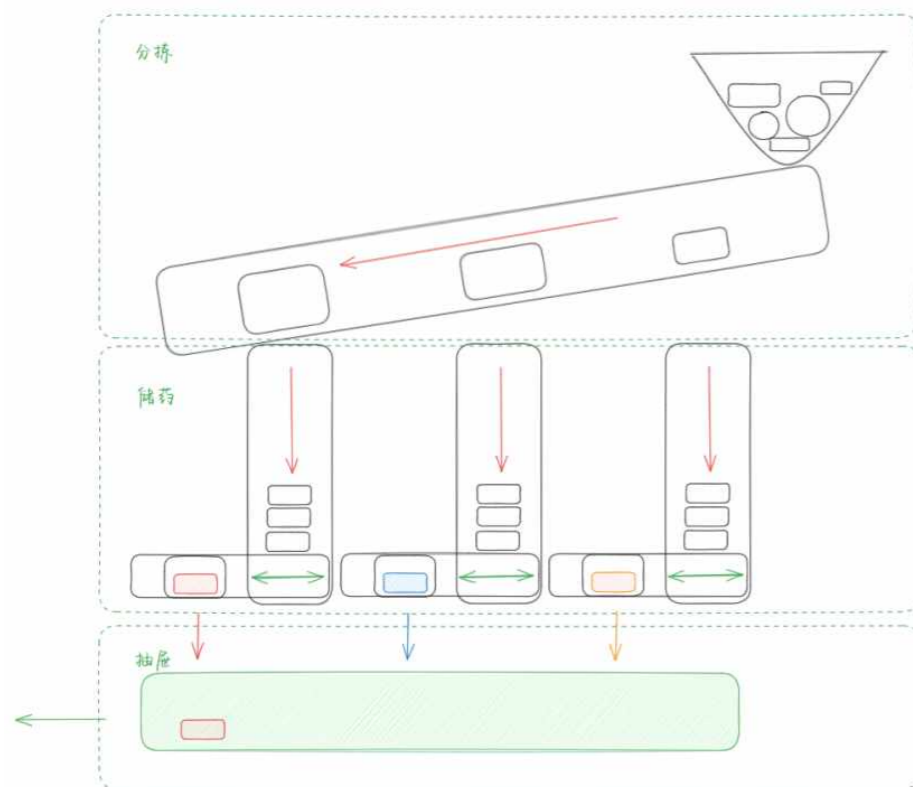


Figure 1.1 Sketch of the overall structural principle

The project is divided into three parts: sorting structure, storage and dispensing structure, and casing. The sorting structure uses different sizes of slots to complete the sorting process of different sizes of tablets and capsules. However, due to the different shapes of the tablets and capsules, there are two completely independent sorting structures in the sorting process. The storage structure is designed according to the corresponding size and shape of the target pills, capsules, and the storage tube. Finally, the push-pull structure is adopted to make the corresponding tablets or capsules fall into the push-pull structure groove, and then fall into the bottom drawer to complete the process of dispensing, storing, and retrieving medication.

II. Hardware design

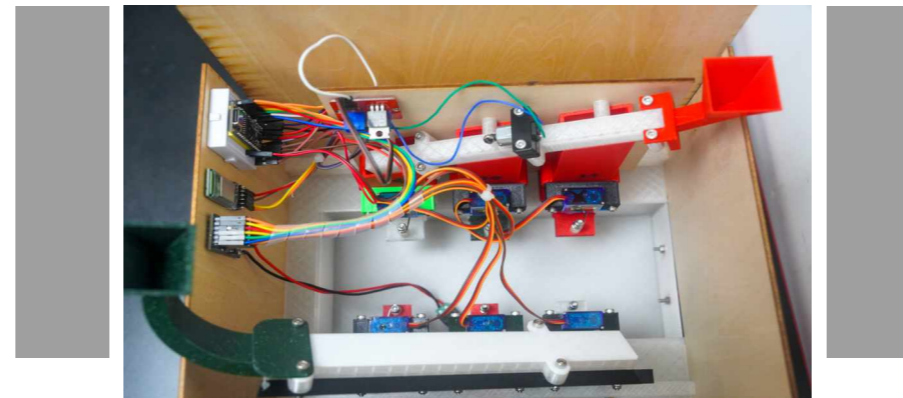


Figure 2.1 Overall Structure Physical Diagram

As shown in the structural sketch, the sorting structure of the physical design is divided into two independent sorting assemblies. The red funnel-shaped structure on the side is the sorting structure assembly of the capsule, while the deep green one is the tablet structure assembly. The majority of the overall structure is made by 3D printing with PETG material.

The main function of the funnel structure is to be used for loading drugs, ensuring that drugs enter the sorting chute in the correct posture and limiting the speed at which pills enter the sorting chute.

The sorting chute structure is divided into two types: capsule sorting chute and tablet sorting chute.

The capsule sorting chute is a sloping chute with three different sizes of rounded rectangular holes arranged from top to bottom, used to sequentially drop capsules of different sizes into corresponding storage cylinders. Due to the special shape of the capsules, it is possible for larger capsules to get stuck at the exit of the small capsule. Therefore, a vibrating motor is installed at the chute cover to assist in the sorting process of the capsules during the sorting process. The tablet sorting chute consists of two inclined slide slots. The tablets enter the sorting chute through a funnel structure and roll through it relying on the inclined walls, then fall into storage cylinders through different-sized slots.

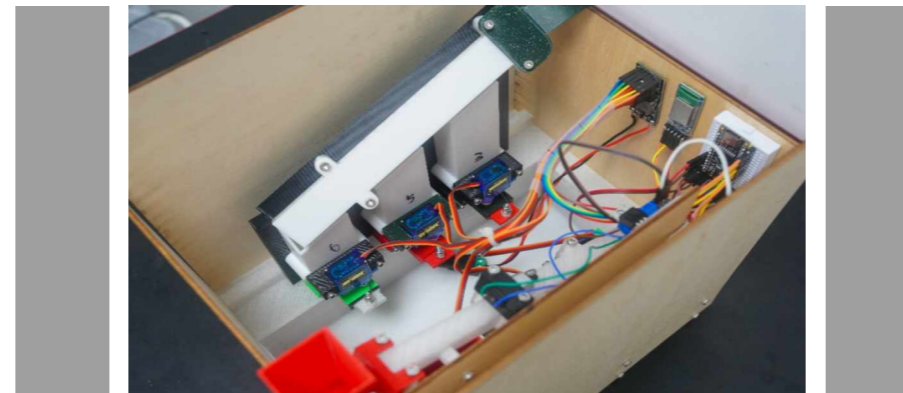


Figure 2.2 Physical diagram of storage cylinder structure.

The storage cylinder assembly can be divided into three parts:
1. Pill funnel, used to guide pills or capsules accurately into the storage tube area.
2. Storage tubes, designed with corresponding shapes for pills or capsules to be stacked in an orderly manner.
3. The discharge chute is pushed by a servo motor and a connecting rod, pushing the tablets or capsules in the discharge chute into the lower medicine drawer.

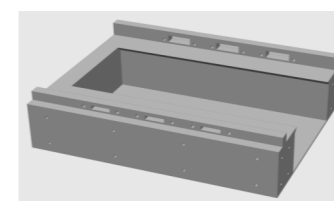


Figure 2.3 Base Model

The shell structure is made of poplar wood board material, designed using Fusion360 and the material cutting process is completed using a laser cutting machine. Fixed on the base with bolts. The base model is used for fixing the sorting assembly, casing, and drawer structure of capsules and tablets.

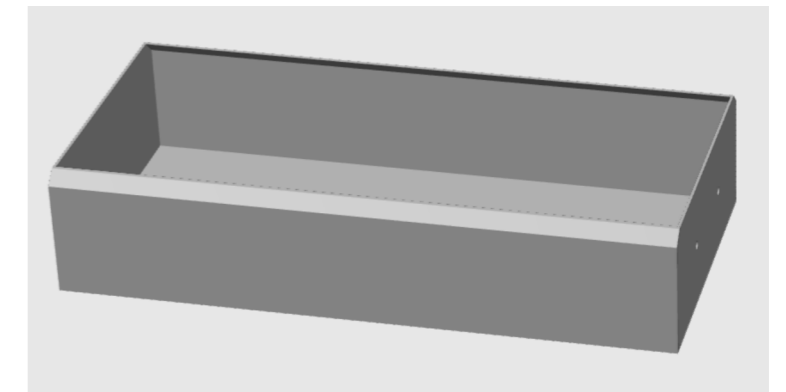


Figure 2.4 Drawer Model

III. Electronic design

The electronic components are shown in the following figure: use the Arduino NANO module as the main control, connect the BT-18 Bluetooth module to interact with the phone. Use the SY8205 servo driver module to control the servo to drive the drug dispensing structure. Use the IRF520 driver module to drive the vibration motor for sorting the capsule structure.

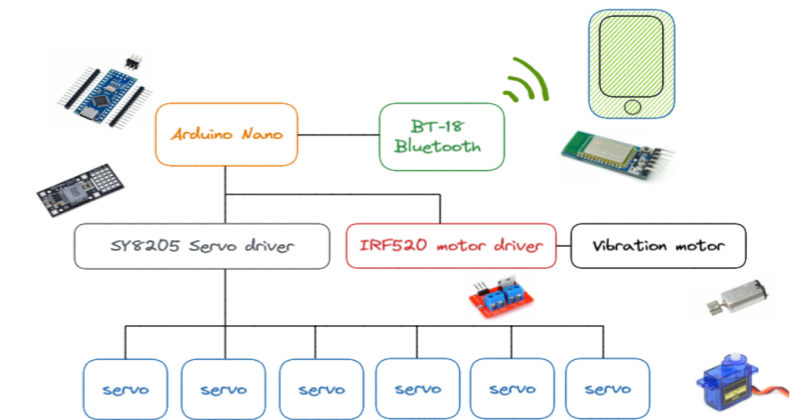


Figure 3.1 Circuit Partial Connection Diagram

IV. Control flow

The overall control process of the device is shown in the following figure:

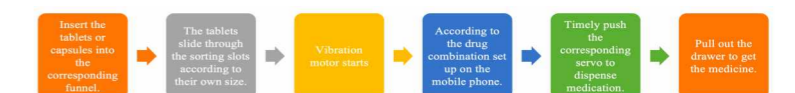


Figure 4.1 Control Flow Diagram

V. Conclusion

This project can achieve the automation of sorting and dispensing three common types of pills and capsules through simple operations. Compared with the existing intelligent medicine boxes, it truly achieves a simple and intelligent medication dispensing solution, and simplifies the operation process, avoiding contact between drugs and fingers as well as the environment, avoiding drug contamination, and effectively solving the difficulty of use for elderly people in this process.