Wearable Automatic Medicine Dispenser

Problem statement:

The wearable automatic medicine dispenser is a device designed to assist users in managing their medication schedules efficiently. It connects to other devices to receive medication schedules and dispenses the required dosages at the appropriate times, accompanied by a reminder alarm. This system aims to minimize the risk of missed doses or incorrect medication intake, ensuring timely and accurate medication management.

Design:

Two Rows of Compartments:

The device features two rows of small, individual compartments, each intended for a different type of medication. This arrangement allows users to organize and manage multiple medications simultaneously, making it a

practical solution for individuals who require complex medication regimens.

Size of Compartments:

Each compartment measures a compact 2 cm by 2 cm, providing enough space to store the required dosage of medications. Despite their small size, these compartments are designed to hold a sufficient quantity of medication, making them both practical and efficient.

Middle Compartment:

At the centre of the device is a larger compartment that serves as the dosage collection point. This middle compartment is connected to the smaller compartments via tube-like structures, allowing for the secure and precise transfer of medication.

Tube Dimensions:

The tubes that connect the smaller compartments to the middle compartment measure 0.8 cm by 0.8 cm. These dimensions ensure a secure and precise transfer of medication from the compartments to the collection point, minimizing the risk of spillage or contamination.

Tube Design:

The tubes are designed with a smooth, curved interior surface, allowing medication to flow freely and easily from the compartments to the middle compartment. The tubes are made of a durable, medical-grade material that is resistant to corrosion and easy to clean, ensuring that they remain hygienic and functional over time.

The above number of rows and sizes are default values and can be changed to best fit the design.

Compartmentalization:

The two rows of compartments are arranged in a clear and organized layout, making it easy for users to identify and access the medication they need. Each compartment is labeled and separated from its neighbors, reducing the risk of confusion or medication errors.

Components Needed:

Microcontroller:

- **The Arduino Nano** is chosen due to its compact size and versatility, making it ideal for wearable devices. It acts as the brain of the dispenser, controlling all operations.

Actuators:

- **Miniature Servomotors:** These are used for opening and closing the medication compartments. They are small and precise, suitable for wearable technology.
- **Solenoid Valves:** These valves control the flow of medication from the compartments to the middle collection compartment.

Sensors:

- **Real-Time Clock (RTC) Module:** This sensor keeps accurate track of time, ensuring medications are dispensed at the correct times.
- **Load Sensors:** These sensors verify that the correct dosage is dispensed, preventing under or overdosing.

Power Source:

- **Lithium Polymer (Li-Po) Battery:** These batteries are small, lightweight, and rechargeable, making them ideal for wearable devices.
- **Battery Management System (BMS):** This system ensures the safe charging and discharging of the battery, extending its lifespan and preventing damage.

Connectivity:

- **Bluetooth Module:** This component allows the device to connect to other smart devices to receive medication schedules and updates wirelessly.

User Interface:

- **OLED Display:** A small screen that displays the current time, the next scheduled dosage, and any alerts or notifications for the user.
- **Buzzer or Vibration Motor:** These components provide audible or tactile alerts to remind the user when it is time to take their medication.

Note: The above components are initial list and as we proceed with the design additional components might be required.

Device Overview:

Circuit Design:

The circuit design of the medication dispenser device is centered around the microcontroller, which acts as the brain of the system. The microcontroller is connected to several key components that enable the device to perform its intended functions.

- **Microcontroller:** The microcontroller is the central processing unit (CPU) of the device, responsible for executing instructions and controlling the various components. It is a small computer chip that is programmed to perform specific tasks.

- **Servomotors**: The servomotors are connected to the microcontroller and are responsible for dispensing the medication. They are precision-controlled motors that can rotate to specific angles to dispense the correct dosage.

- **Solenoid Valves:** The solenoid valves are also connected to the microcontroller and are used to control the flow of medication from the compartments to the dispensing mechanism.

- **RTC (Real-Time Clock) Module:** The RTC module is connected to the microcontroller and is responsible for keeping an accurate record of the current time. This is essential for scheduling medication dispensing at specific times.

- **Load Sensors:** The load sensors are connected to the microcontroller and are used to detect the presence or absence of medication in the compartments.

- **Bluetooth Module**: The Bluetooth module is connected to the microcontroller and enables the device to communicate with other devices wirelessly. This allows for remote updates and management of the medication schedule.

- **OLED Display:** The OLED display is connected to the microcontroller and is used to display relevant information to the user, such as the current time, next dosage, and alerts.

- **Power Source (Li-Po Battery):** The power source is a Li-Po battery that is connected to the microcontroller through a Battery Management System (BMS). The BMS ensures safe operation of the device by monitoring the battery's state of charge and preventing overcharging or undercharging.

Programming the Microcontroller:

The microcontroller is programmed to perform specific tasks using a programming language such as C or Python. The programming involves several steps:

- **RTC Module Setup:** The first step is to program the RTC module to keep an accurate record of the current time. This involves setting the initial time and date, as well as configuring the RTC module to update the time automatically.
- **Actuator Control:** The next step is to write code to control the servomotors and solenoid valves. This involves programming the microcontroller to send specific signals to the actuators to dispense the correct dosage at scheduled times.
- **Bluetooth Connectivity:** The microcontroller is programmed to implement Bluetooth connectivity, allowing it to receive medication schedules from other devices wirelessly. This enables remote updates and management of the medication schedule.

- **User Interface Management:** The microcontroller is programmed to manage the user interface, which includes the OLED display and buzzer or vibration motor. The OLED display shows relevant information such as the current time, next dosage, and alerts, while the buzzer or vibration motor is used to activate reminders.

Operational Overview:

Initialization:

When the device is powered on, it initializes the RTC (Real-Time Clock) module and establishes a Bluetooth connection. The RTC module is responsible for keeping track of the current time, while the Bluetooth connection allows the device to communicate with other devices, such as a smartphone or computer. The device then displays the current status, including the time and any initial alerts, on the OLED screen.

Retrieving the Medication Schedule:

The device connects to a paired smartphone or computer via Bluetooth to download the medication schedule. This schedule is stored in the microcontroller's memory for reference. The medication schedule includes information such as the medication name, dosage, and dispensing time.

Time Monitoring:

The RTC module continuously monitors the current time. When the current time matches a scheduled medication time, the microcontroller activates the appropriate servomotor or

solenoid valve. This action opens the corresponding compartment, allowing the medication to flow into the middle collection compartment.

Dosage Verification:

The load sensors check the amount of medication dispensed, ensuring the correct dosage is administered. If the dosage is incorrect, the system can alert the user or adjust the dispensing process. This feature helps prevent medication errors and ensures that the user receives the correct dosage.

User Notification:

The device triggers the buzzer or vibration motor to alert the user that it is time to take their medication. The OLED display shows detailed information about the medication and the dosage to be taken. This feature helps ensure that the user is aware of their medication schedule and can take their medication as prescribed.

User Confirmation:

After the user confirms that they have taken the medication, they indicate this by pressing a button or some other form of confirmation. This feature helps the device keep track of the medication schedule and ensures that the user is taking their medication as prescribed.

Schedule Update:

After the user confirms that they have taken the medication, the device updates its schedule and prepares for the next dispensing time. This process repeats, ensuring continuous and accurate medication management.

Summary:

The Wearable Automatic Medicine Dispenser is a innovative device designed to assist users in managing their medication schedules efficiently. With its compact design, user-friendly interface, and advanced features such as real-time clock, load sensors, and Bluetooth connectivity, this device ensures timely and accurate medication delivery, minimizing the risk of missed doses and medication errors.