Team Atulya

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Abstract

The Automatic Drug Dispenser Project revolutionizes medication management by introducing an innovative solution that seamlessly integrates patient information, doctor's prescriptions, and pharmacy automation. In this modern healthcare ecosystem, patients initiate the process by registering at the hospital through a user-friendly Google Form. Once registered, doctors utilize a dedicated app to prescribe medications tailored to the patient's needs.

The heart of this system lies in the generation of a prescription receipt enriched with a unique QR code, providing a secure link between the medical prescription and the medication dispensing process. Patients can then visit a nearby pharmacy equipped with our cutting-edge "QR Code Drug ATM Machine." Here, the prescription QR code is scanned, and a new QR code is generated for payment.

Upon successful payment, the "QR Code Drug ATM Machine" springs into action, packing medications into day-wise packets precisely in accordance with the doctor's prescription. This automated, patient-centric approach ensures accurate and timely medication dispensing, reducing the risk of errors and enhancing medication adherence.

The Automatic Drug Dispenser Project simplifies the medication fulfilment process and empowers patients to take control of their healthcare journey. With its potential to improve medication management in diverse healthcare settings, from homes to hospitals, this project stands at the forefront of healthcare innovation, offering a brighter and more efficient future for patients and healthcare providers alike.
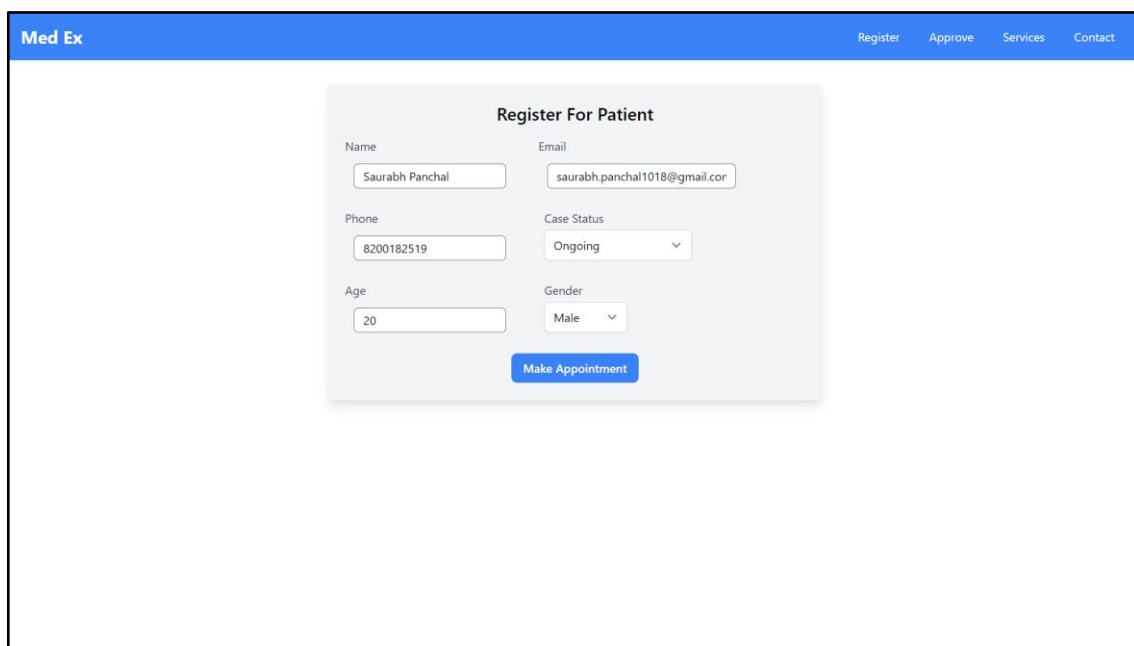
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Chapter-1 Software

1.1 Patient Registration for an Appointment:

The doctor's interface has a section where a patient's registration is done for an appointment. This section may include fields for the patient's name, contact information, Age, Gender, Case Status, and any relevant medical history or insurance information.
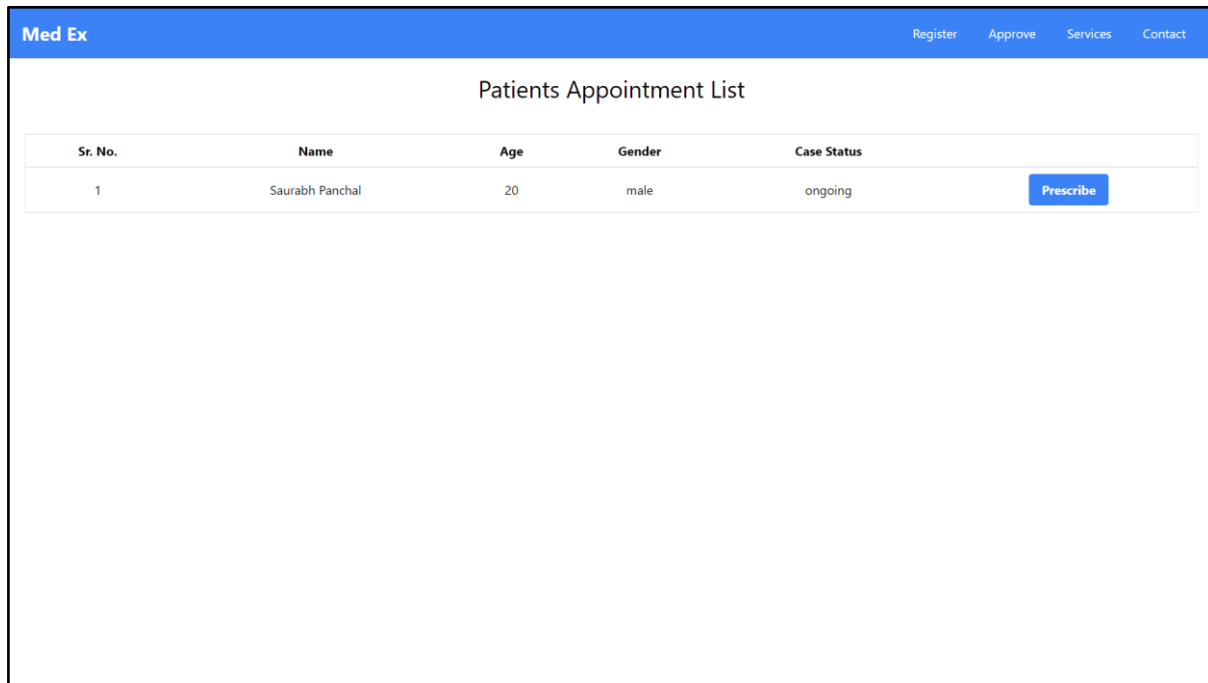

[Figure-1.1: Patient Registration for an Appointment]

1.2 Doctor's Approval:

The doctor can access a list of pending appointment requests and approve them. The doctor clicks on the **Prescribe** button to give the prescription.

[Figure-1.2: Doctor approves the appointment and gives prescription]

1.3 Adding Medication:

In the doctor's interface, a search functionality allows the doctor to find the specific medicine they intend to prescribe. Once the medicine is located, the doctor can save its prescription details, which include:

Dosage: This refers to the quantity of the medication to be taken and the duration for which it should be consumed. It may specify the number of days, weeks, or months the patient should take the medicine.

Duration: This specifies for how long the patient should continue taking the medication, often expressed in days.
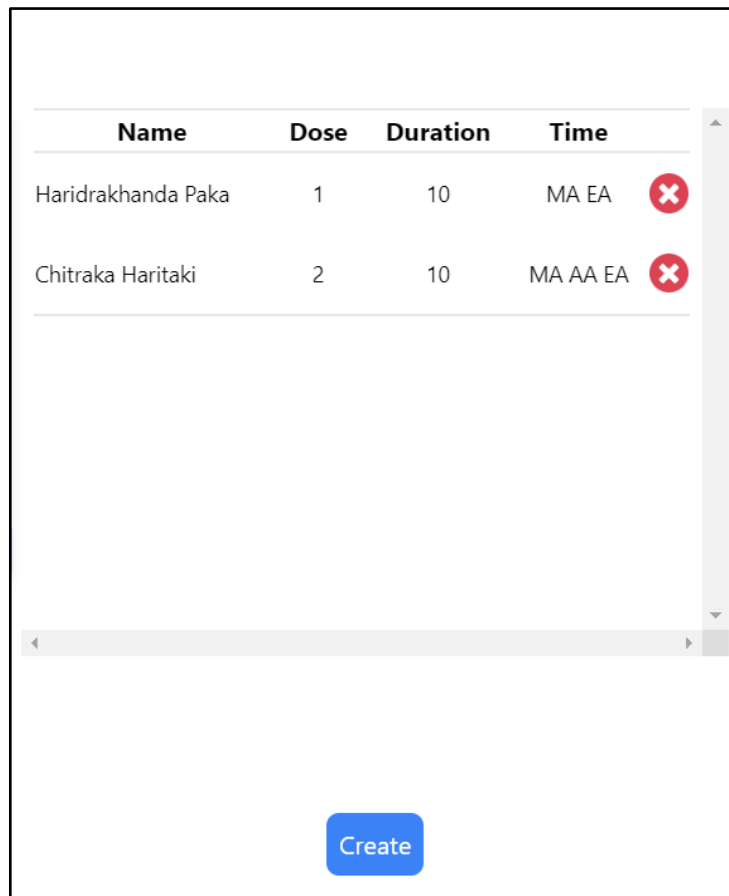
Timing: This specifies when the medication should be taken during the day. This can encompass various options such as "Morning before breakfast," "Morning after breakfast," "Afternoon before lunch," "Afternoon after lunch," "Evening before dinner," "Evening after dinner".
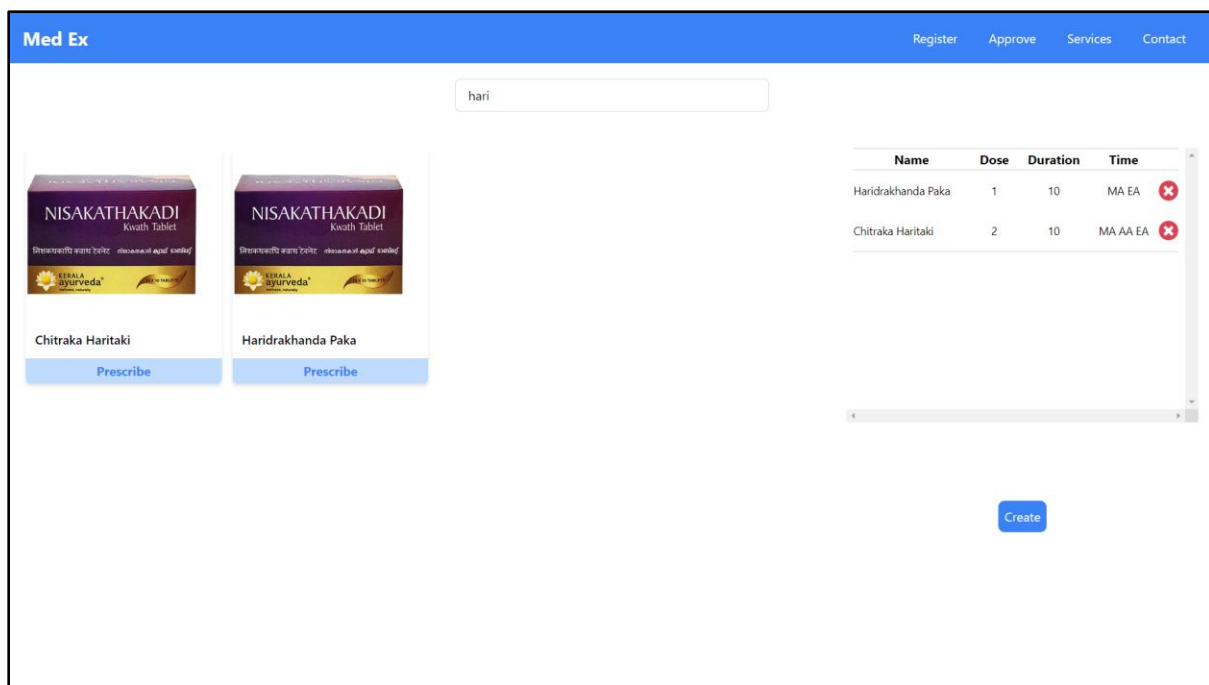
[Figure-1.3: Prescription Interface]

1.4 Medication List Formation:

As the doctor fills in the details for each medication, a list is dynamically generated on the right side of the interface, which displays the prescribed medications along with their dosage and timing information. Each medication in the list can be manually removed by the doctor if necessary. After reviewing and finalising the list of prescribed medications, the doctor selects a "Create" button. Clicking "Create" triggers the prescription generation process.

Name	Dose	Duration	Time	
Haridrakhanda Paka	1	10	MA EA	✖
Chitraka Haritaki	2	10	MA AA EA	✖

Create

[Figure-1.4: Right pane contains the list of medications]

1.5 Prescription Interface:

The prescription interface is generated and made ready for printing.

It includes all the prescribed medications, their dosages, and the specified timing details. Additionally, the prescription interface may include patient information, doctor's details, and any other relevant medical instructions.

Doctor's Prescription
Name: Saurabh Panchal
Age: 20
Gender: male

Prescription List

Medicine Name	Duration	Dose	Timing
Haridrakhanda Paka	10	1	MA EA
Chitraka Haritaki	10	2	MA AA EA

Follow this prescription as instructed. Consult your doctor if you have any questions.

[Figure-1.5: Prescription Receipt generation]

1.6 Printing the Prescription:

The doctor can then print the prescription, which can be handed over to the patient for medication fulfilment at a pharmacy. This printed prescription will include a QR code that encodes the patient's details and the medication information, ensuring a secure and efficient medication dispensing process at the pharmacy.

[Table-1.1: Prescription Receipt generation]

QR Code Contains	**Prescription in number format**
	Ex: 1-2-3-4-5-'abcd'
	1 = Medicine ID
	2 = Time ID (Morning, Evening, Noon)
	3 = Number of Days
	4 = Number of Tablets per Time
	5 = Price of the Medicine
	'abcd' = Name of the patient

Chapter-2 Hardware

2.1 QR Parsing

2.1.1 QR Code Scanning:

The QR code scanner captures the QR code's visual representation.

2.1.2 Data Extraction:

The Arduino is programmed to extract the data from the scanned QR code. In this case, it extracts the numerical values 1-2-3-4-5-'abcd'

2.1.3 Data Interpretation:

The Arduino interprets the extracted data as follows:

1: Medicine ID - Identifies the specific medication.

2: Time ID - Indicates the timing for medication (e.g., morning, evening, noon).

3: Number of Days - Specifies the duration for which the medication should be dispensed.

4: Number of Tablets per Time - Determines the quantity of tablets to be dispensed per dose.

5: Price of the Medicine - Represents the cost of the medication.

6: 'abcd' = Name of the patient

[Figure-2.1: QR Code Scanning Module]

2.2 Base Structure

2.2.1 Main Base:

This forms the primary structural support for the entire device. It provides stability and houses critical components like motors and electronics.
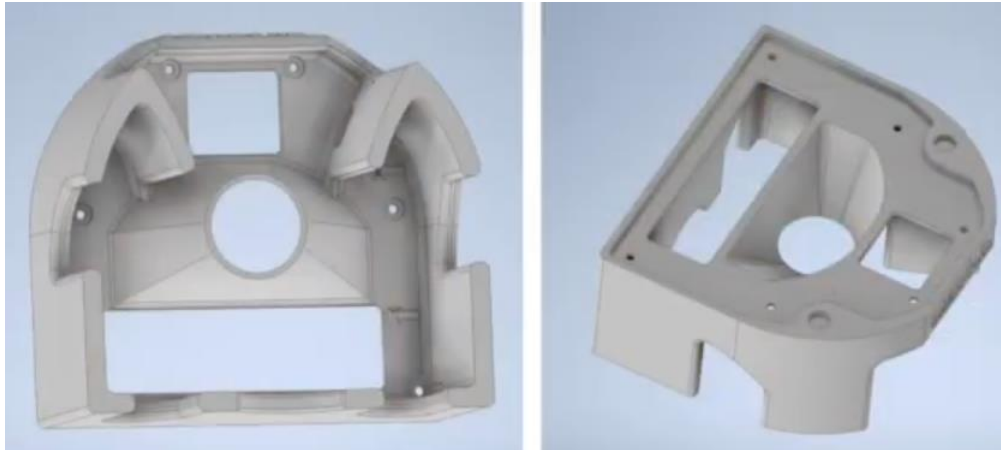
[Figure-2.2: Main Base Design]

2.2.2 Cylinder Base:

The cylinder base is designed to securely hold and align the pill storage cylinders. It ensures that the cylinders are correctly oriented during the dispensing process.

[Figure-2.3: Cylinder Base Design]

2.2.3 Tray:

This is the platform where the pills are collected and subsequently dispensed. Additionally, it features a shelf to hold the Arduino microcontroller, which controls the machine's operations.

[Figure-2.4: Medicine Collection Tray Design]

2.3 Cylinder Design

The cylinders are a fundamental part of this, offering flexibility and ease of use:

- **Removability:** The cylinders are designed to be easily detachable from the base. This feature enables users to load or unload pills conveniently and allows for effortless cleaning.

[Figure-2.5: Cylinder Designing]

- **Gear Mechanism:** To transfer the rotation of the motors in the base to the cylinders, gears are employed. These gears ensure smooth operation even if the cylinders are not perfectly aligned when placed on the base.

[Figure-2.6: Gear Mechanism]

- **Modular Design:** The cylinders are modular and can accommodate different components to accommodate pills of varying sizes and shapes. The key modular components include:

  - **Rotating Disc:** These discs vary in thickness to match the height of pills and have unique slots to fit specific pill shapes.

[Figure-2.7: Rotating Disc]

  - **Agitator Piece:** The agitator ensures continuous movement of pills within the cylinder, preventing pill bunching.
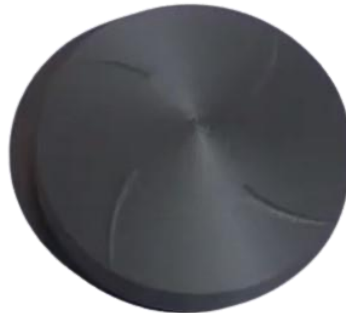
[Figure-2.8: Agitator piece]

  - **Sweeper Arm:** Positioned above the cylinder's bottom hole, the sweeper arm ensures the precise dispensing of a single pill when the slot in the rotating disc aligns with the cylinder's hole.

[Figure-2.9: Sweeper Arm]

2.4 Stepper Motor Specifications:

[Figure-2.10: 28BYJ-48 Stepper Motor and ULN2003 Stepper Motor Driver (Ref.)]

- The automated dispensing mechanism is centrally controlled by a stepper motor system. The design incorporates 28 BYJ stepper motors, dedicated to a specific medication container.

- The motor operates at a regulated 5 volts, aligning with the power requirements of the overall system.

- The 28 BYJ stepper motor delivers a robust torque of almost 40 micro newton-meters, surpassing the necessary torque for efficient pill dispensing. This substantial torque ensures reliable operation even when dispensing pills of varying shapes and sizes.

- The stepper motor features a step angle of 5.6 degrees over 64, allowing for a high degree of precision in control. With this step angle, a single rotation can be divided into over 4000 steps, providing exceptional accuracy. The high precision of the stepper motor translates to accurate dispensing of medications.

- This eliminates concerns about discrepancies, such as over-dispensing or under-dispensing, as each step in the rotation corresponds to a controlled movement in the dispensing mechanism.

- The 28 BYJ stepper motor ensures a cost-effective solution without compromising on the precision and accuracy required for medication dispensing.

2.5 Assembly and Usage:

To set up and use Automatic Drug Dispenser Machine:

- **Base Assembly:** Assemble the three base components (main base, cylinder base and Tray) securely using nuts and bolts.

- **Motor Attachment:** Attach the motors to the cylinder base using nuts and bolts.

- **Cylinder Gear Installation:** Slide the cylinder gear onto each motor shaft, ensuring a secure fit.

- **Cylinder Attachment:** Place the cylinders onto the base, ensuring the gears align with the gears on the base. This allows for easy removal and attachment of cylinders.

- **Modular Components:** Customize the cylinders with the appropriate modular components rotating disc, agitator piece and sweeper arm based on the pill size and shape.

- **Medication Loading:** Pour the medication into the appropriate cylinder.

- **Operation:** The machine is now ready to dispense medication automatically according to the programmed circuitry.

2.6 Packaging and Printing Mechanism

2.6.1 Packet Preparation:

After the collection mechanisms, the individual medication packets created are ready for the final step of the process.

2.6.2 Packaging Machinery:

The Vertical Form Fill Seal machines (VFFS) are packaging machines that form, fill, and seal a package on the same machine.

[Figure-2.11: Packaging Machinery]

2.6.3 Sachet Specifications:

Each packet typically consists of a pocket or pouch made from the dispensed packaging material.

The specifications of the sachet are as follows:

- Initial form: Film roll of at least 100 meters

- Material: Chromo PE paper

- Thickness: 70GSM Chromo paper + 20 GSM PE layer = 90 GSM

- Features: Water resistant, Improved strength, Light exposure resistant, fairly heat resistant, Safe for drug storage

- Sustainability considerations: Biodegradable, Environment friendly, dust-free
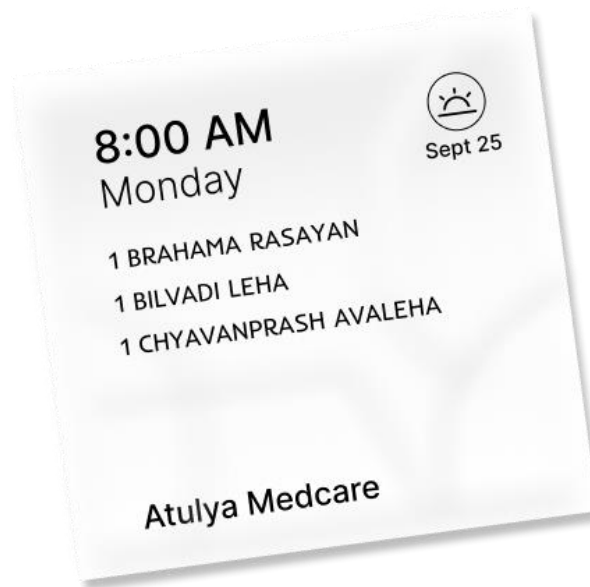
[Figure-2.12: Final Sachet]

2.6.4 Laser Printing:

The laser printer is a crucial component responsible for adding essential information to each medication packet. This information typically includes:

- **Timing Information**: The timing at which the medication should be taken, such as "Morning," "Evening," or "Noon."

- **Medication Details**: This includes the medicine name, dosage, and any specific instructions regarding its administration.

- **Date**: The date of prescription issuance or packaging for reference.

- **Expiry Date**: The expiry date of each pill that is contained in the sachet.

- **Other Identifiers**: Any additional details that may be required, such as patient name, patient Id, serial number or prescription number, depending on requirements.

Chapter-3 Comparison

Table-3.1 indicates concise overview of diverse technological solutions aligned with the same business model, aimed at enhancing comprehension regarding why **<u>Atulya</u>** distinguishes itself.

[Table-3.1: Comparison Table]

Specifications	Atulya	Pillpack	Hero Health Alarm Dispenser	Synergy Medicine Vending Machine	Pharmallama
Doctor's Prescription	Mandatory	Not mandatory	Not mandatory	Not mandatory	Mandatory
Subscription Required	No	Yes	Yes	No	No
Machine Operation Mode	Automatic	-	Automatic	Manual	-
Consumer deals with	Software + Hardware	Software	Software + Hardware	Hardware	Software
Detailed Dosage Description	Yes	Yes	Yes	No	Yes
Dosage Description	On sachet	On sachet	Alarm alert	No	On sachet
Product/ Service based mechanism	Product	Service	Product+ Service	Product	Service
References	-	https://www.pillpack.com	https://herohealth.com	https://synergysafety.com	https://pharmallama.com

Chapter-4 Conclusion

In conclusion, the Automatic Drug Dispenser Project represents a significant leap forward in **healthcare innovation**, offering solutions that not only simplify medication management but also have the potential to transform the way healthcare is delivered. With the integration of **cutting-edge technologies like IoT** the project's future scope holds promise for improving medication adherence, patient outcomes, and the overall healthcare experience. The adaptability of this technology, from **elderly care to global healthcare markets**, showcases its versatility and potential impact. As we move forward, it is imperative to continue collaboration between healthcare professionals, technology experts, and regulatory bodies to bring these advancements to fruition, ensuring safer, more efficient, and sustainable healthcare practices for all. The Automatic Drug Dispenser is not just an innovation; it's a **vision of a healthier and more accessible future for patients and healthcare providers alike**.