Creating a Modern Electronic Medical Records (EMR) System

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Abstract

This project will attempt to create a functional, user-friendly medical management and medical records (EMR) system. Web-based programming languages, such as PHP, HTML, and CSS will be used with MySQL databases. Databases will be designed using the Relational Database Model and considering the ACID (Atomicity, Consistency, Isolation, and Durability) paradigm. The EMR design will ensure expandability, intuitive interface, and practicality for the end user.

User ID	Last Name	First Name
01	Jobs	Steve
02	Gates	Bill

| User ID	Phone #
01	7031234567
02	7039876543
02	7035555555

Relational Database Model

The Relational Database Model is crucial to ensure the flexibility of the database behind this EMR. Each individual in the system has a unique, global User ID. This same ID is used to relate all data belonging to this individual across many focused tables. For example, the individual Steve Jobs here has ID "01." Looking up this ID in the *names* table will associate the record of his first and last name. Because each individual has a completely unique ID, the Relational Model can allow infinite flexibility in number of records. For instance, ID "02" is associated with 2 records in the *phones* table, indicating hat Bill Gates has two different phone numbers listed. While in this example the advantage to flexibility is minimal, in the medical field data can literally define life or death. If a physician cannot list all the medications a patient is taking, for example, he/she could be given a medication by another doctor that has a lethal interaction with the unlisted drug.

Hierarchical Database Organization

Along with the Relational Model, this hierarchical design was created in order to allow a digital representation of data most similar to the physical one in place today. Patient is the highest entity, and he/she can have multiple Charts, containing related data to be decided by the physician. The Chart is comprised of multiple Sheets, each representing a specific interaction with the physician, such as a doctor's visit. A Sheet can have multiple Records of different data types, such as a typed text report or a custom return-visit template.
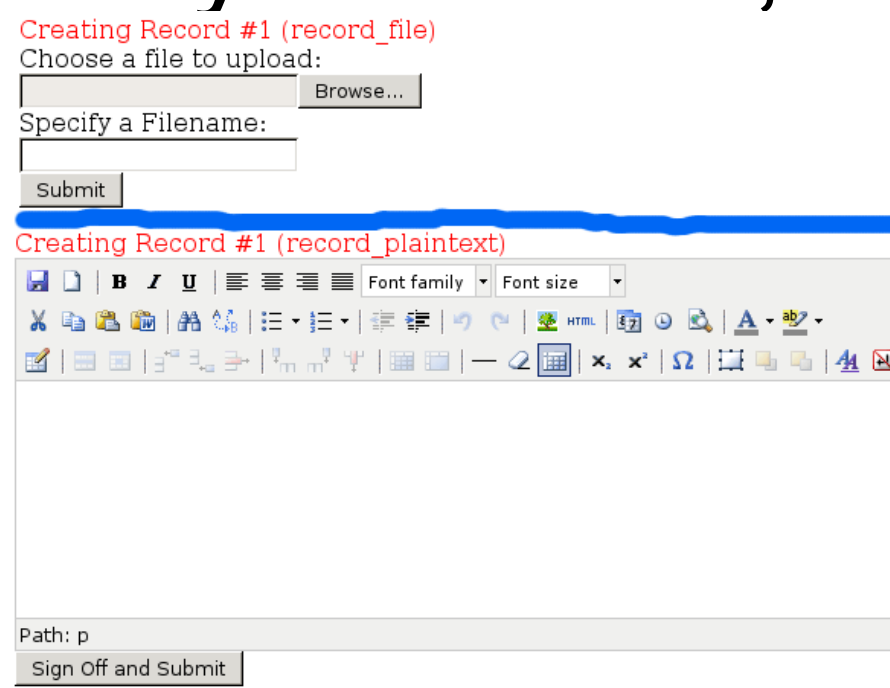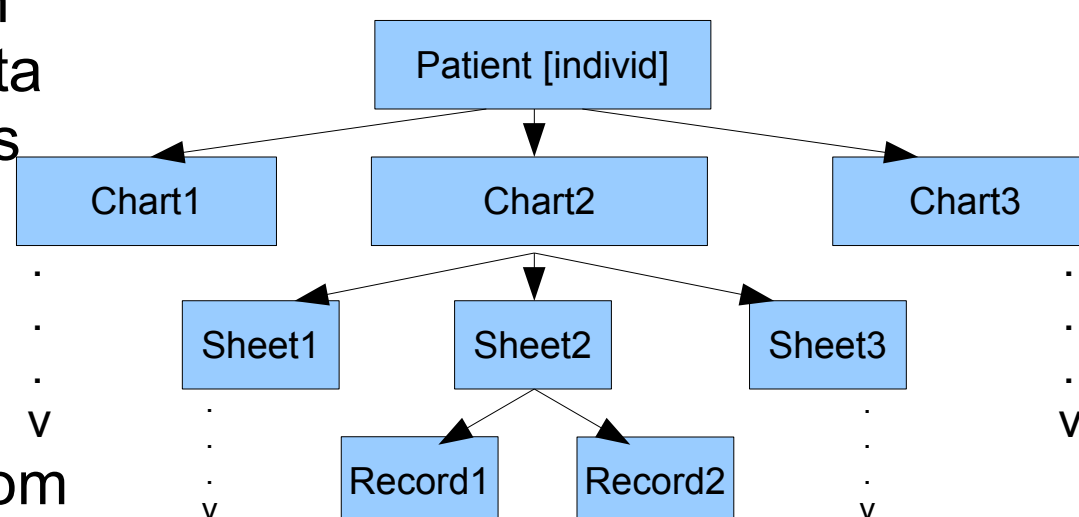

Input Types

A modern EMR system should allow physicians to input data in a variety of ways. In addition to Template-based entry (detailed below), this project supports data entry as a rich-text note (integrating the LGPL program TinyMCE) and as uploaded images (for scanned/drawn material).

Autocomplete

There are many phrases doctors type repeatedly. This is to be expected, as there are only so many allergies that people typically have. Using AJAJ (*A*synchronous *J*avascript *a*nd *J*avascript *O*bject *N*otation), this field takes the characters typed, sends them to a PHP file that looks in a database table and returns an array of options that begin with the typed letters. The user need only click on the desired choice to complete the phrase.
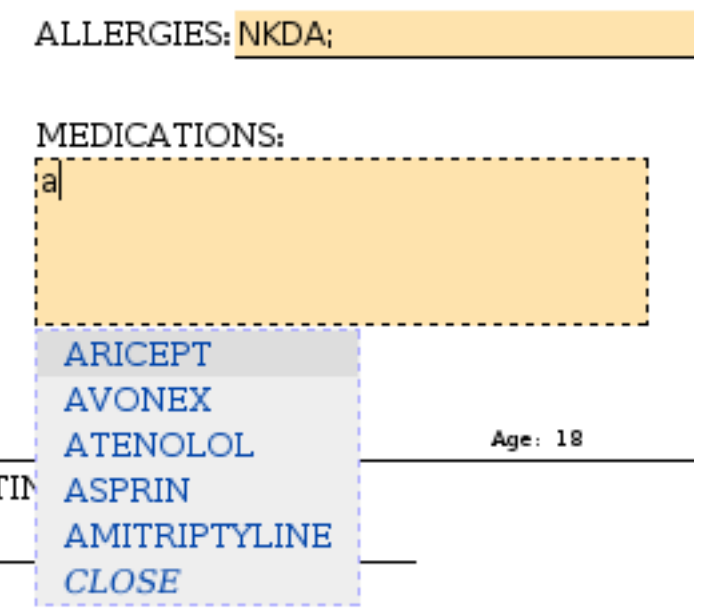

Hand-Coded vs. Function-Generated Templates

Initially, physician templates were exclusively coded by hand in HTML and CSS. However, this process was tedious and error-prone. The best solution was to create a library of PHP functions to automate the creation of template elements. These two images show the code needed to display the same form elements in hand-coded HTML and with the template-creation functions.
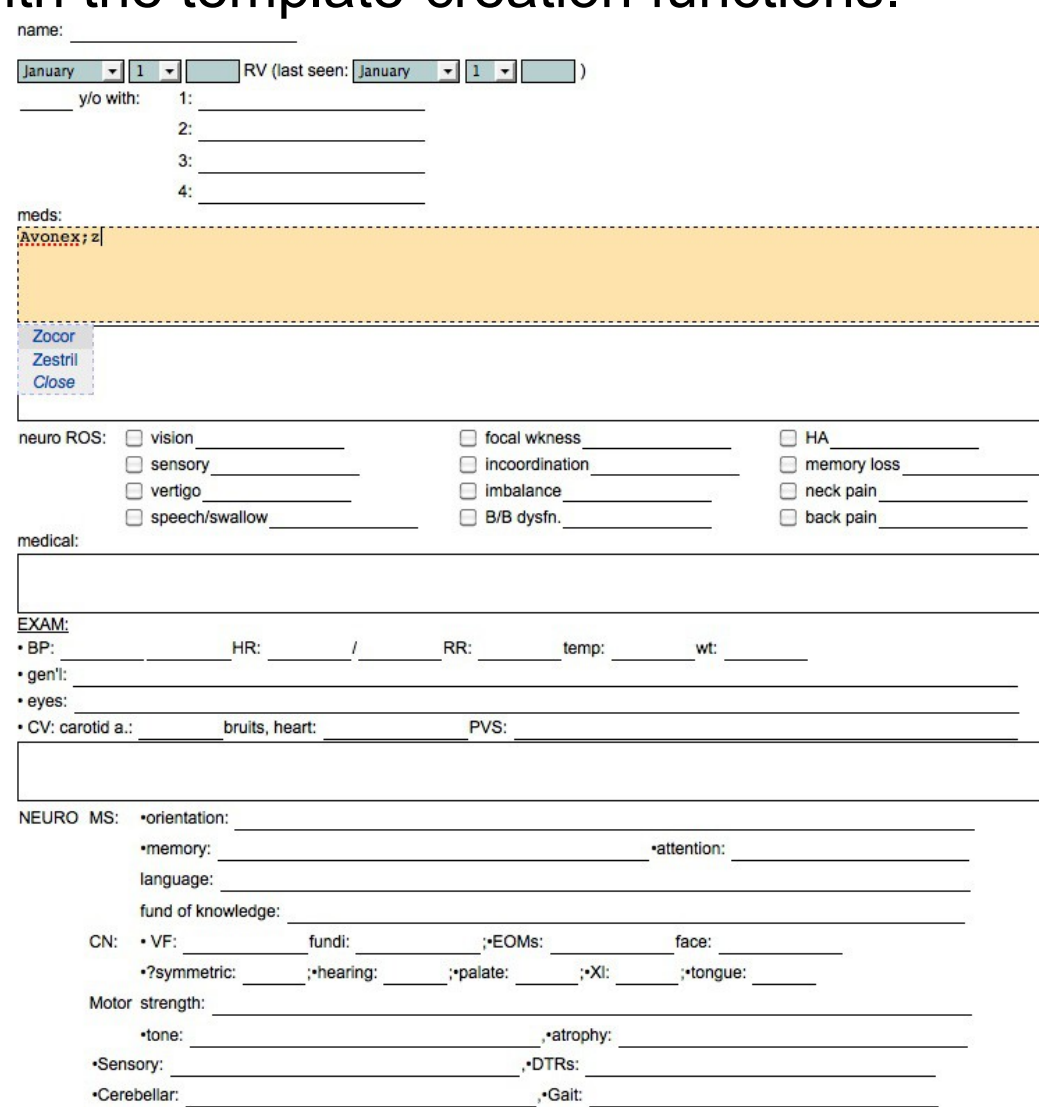
Templates

Why does an EMR even need templates? Why can't the physician just type up their notes about a patient? Doctors perform similar examinations for many of their patients, focusing on specific areas that may differ. Certain phrases in a doctor's note may literally be repeated for every patient. The purpose of a template is to make as many of a doctor's routine tasks as simple as possible so he/she can focus on what is abnormal.

The beauty of EMR is the ability to automate even more tasks than on paper. This template uses autocomplete, checkbox, and drop-down inputs to reduce the times a doctor has to type out a long phrase indicating a routine exam result.