

DESIGN RATIONALE

TEAM 33

COMP 3004

AED PLUS

Overview:

This document presents rationale behind design decisions, such as patterns used and values and thresholds for things in the program.

Patterns Used:

Command Pattern

Used to implement PowerOn, AnalyzeHeartRhythm, DeliverShock and InstructCPR. The advantage of the pattern is that it is intrinsic to the operation of an AED, where the AED is simply dishing out commands to its respective components and the commands are executing on behalf of the controller. Also made it very easy to split up work since each command is isolated from the rest. So long as PatientData and AudioVisualHandler is passed as references for the command to act upon, each command can operate in its own right.

Signals and slots, Observer pattern

Used for UI elements obviously. Additionally, custom signals and slots were written to notify classes of changes in its data. For example, after the CPR simulation is finished, it emits a signal to notify PatientData of a new HeartRhythm, which triggers AnalyzeHeartRhythm to re-analyze the patient. AEDStatus: Observe & track changes in AED status, gives GUI real time Updates.

Singleton

Only one instance of the AEDController should exist at any time as it is the sole manager of core functions that affect the patient. AudioVisualDisplay is also a singleton, since we only ever work on one patient with an AED.

Values and Thresholds

Battery, Drainage

Depending on the type of electrode attached and amount of times shocked, charge up a different amount of electricity. Adult shock values are 120j/150j/200j. Child shock values are 50j/70j/85j. There is 4500j available. Before two shocks, the battery is depleted by 200j, then $120 + (\text{times shocked} * 30)$ for an adult. For peds, it is 85j if less than two shocks then $50 + (\text{times shocked} * 20)$. This is because the AED should reduce the total shock amount after each consecutive shock to prevent damage to the heart.

Heart Analysis and Rhythm Types

This program uses movies to display the heart rhythm signal as a generic type. The following is a mapping of integer values to corresponding heart rhythm types:

TYPE	VALUE	SHOCKABLE?
PEA	0	No
Asystole	1	No
VF	2	Yes
VT	3	Yes

CPR Simulation

CPR Simulation permits 2 minutes of CPR activity (as recommended by first-aid material). This should include up to **two** cycles, where one cycle is 30 compressions and 2 breaths. The user is permitted a variance of 10 compressions.

The CPR simulation tracks rate of compressions at an objective of 120 BPM and provides feedback at a sampling time of 5 seconds. There is a slider to change compression depth.

Depending on how good the CPR is, the compression rates will be averaged to produce a probability of the patient heart signal changing to a certain type. If CPR has been given multiple times, it will increase the probability of a shockable signal or PEA by $1.25^{(\text{CPR COUNT})}$. That is, an exponential curve is used to increase the probability of a shockable or PEA signal after consecutive attempts. If shocks have been delivered beforehand, an additional 5% chance of shockable rhythm being selected is added to the shockable and PEA signals. The next patient heart rhythm is selected by weighted randomization.