Bread bake machine

A customer wants you to develop software for a bread baking machine. Below you'll find some design pictures of what the machine could look like (picture to the right shows what's under the grey lid):

How the machine works:

A user takes the bread pan from the unit and puts the right amount of basic ingredients for bread in the pan: flour, water, salt, sugar and oil. When this is done, the bread pan is reinserted in the unit and the top lid is closed. Yeast is inserted in the special yeast tray under the grey cover: the machine automatically adds the yeast to the dough at the end of the knead phase. This is done as late as possible as yeast will die when it is exposed to salt for too long.
Next to the yeast tray, you will find a separate raisin/nut dispenser. When the right program is selected, these will be added to the dough at a later time as well, to prevent breaking the nuts while kneading.
The bread baker has different programs:

1. plain bread: for "normal" bread
2. bread +: for raisin bread or bread with nuts
3. rapid: a faster program. The resulting bread will have a less pleasing structure but is baked much faster
4. dough: a program that makes dough but doesn't bake it
5. bake: a program that only bakes

When all ingredients are added, the user presses the program button to wake up the machine, this selects program 1. Each additional time the user presses the program button, the next program is selected. The display will show the program number and the required time. After selecting the program the user can optionally set a timer. This timer will delay the program start, the display will always show how long it takes before the bread is ready. Programming the timer is done with the “time +” and “time -“ buttons that increases or decreases the program length by 10 minutes. Obviously the time cannot get shorter than the normal program length. The maximum time that can be selected is 12 hours. The user starts the program by pressing the start button, starting the program is only allowed when the oven temperature is lower than 50 degrees Celsius. If a user fails to press any button for 5 minutes, the machine will return to standby mode. After the baking program is finished, the machine will also go to standby mode after 5 minutes. A program can be canceled by pressing and holding the menu button for 2 seconds. This will immediately take the machine back to standby mode.

The table below describes what each program does (the program will be executed sequentially from left to right):

program nr and name		rest	knead*	rise	bake	total
1	**plain bread**	60	20	160	50	4 u 50 min
2	**bread +**	60	20	160	50	4 u 50 min
3	**rapid**	0	15	60	40	1 u 55 min
4	**dough**	40	20	80	-	2 u 20 min
5	**bake****	-	-	-	30 - 90	30 - 90 min

*) Yeast is added in the second half of the kneading phase (e.g. with plain bread after 10 minutes). In program 2 the nuts/raisins are added after 15 minutes. Kneading means: letting the knead motor turn right for 1 minute, then turning it left for 1 minute, etc. until the time is finished.

**) In the bake program you can use the “time +” and “time -“ buttons to control the baking time. The baking time is 30 to 90 minutes. You cannot use a timer together with the bake program.

The LCD shows the following information:
- current job indicator: waiting, kneading, rising, baking, done
- program number
- remaining time in hours:minutes (is updated each minute)

The start button also has a LED that indicates that a program is active. When the temperature is too high to start a program, this led will blink 10 times with a 1Hz frequency and no program is started. While the led is blinking, the machine doesn’t respond to any button.
The LCD with all buttons looks like this:

The bread bake machine has the following library functions, the gray functions are used internally by the event generator, so you shouldn't need to call them yourself:

hardware	library functions	description
display	SetCurrentTask(tasknr: int)	indicates what the machine is currently doing: 0: no indicator 1: waiting 2: kneading 3: rising 4: baking 5: done
	SetMenuNumber(number: int)	shows the given menu number on the display.
	SetTime(hour: int, min: int)	shows the remaining program time in hh:mm.
	DisplayOff()	hide all indicators on the display.
event generator	GetEvent(): Events	returns the last event that occurred, or NoEventOccurred if no event has occurred.
extra ingredients tray	Drop(time: uint64_t)	after *time* ms, the extra ingredients dispenser is opened.
	Cancel()	cancels the scheduled extra ingredients dispenser opening action.
knead motor	TurnLeft()	switches the knead motor on in left direction
	TurnRight()	switches the knead motor on in right direction
	Stop()	stops the kneading motor. **Important**: the motor cannot be switched from left to right without stopping the motor in between!
oven	StartRise(timeInMinutes: int)	starts the oven in "rising" mode (35 °C), after timeInMinutes the oven will automatically turn off.
	StartBake(timeInMinutes: int)	starts the oven in "baking" mode (200 °C), after timeInMinutes the oven will automatically turn off.
	SwitchOff()	switches the oven off.
	IsOn(): bool	returns if the oven is switched on.
	GetTemperature()	returns the oven temperature in degrees Celsius.
start button led	LedOn()	enables the start button LED.
	LedOff()	disables the start button LED.
timer	Set(time: uint64_t)	sets the timer to a given number of milliseconds. When a timeout occurs, the TimerTimeout event is given.
	Cancel()	cancels the current timer.
user actions	*all*	are only used by the event generator.
yeast tray	Drop(time: uint64_t)	after *time* ms, the yeast tray is opened for about 2 seconds.
	Cancel()	cancels the scheduled yeast drop action.

This project comes with a complete hardware simulation, make sure you read the simulator manual!