

COA202 Embedded Systems Programming Coursework

Specification

In this coursework, you are given an Arduino Uno and LCD keypad shield. Your assignment is to develop a software that simulates a virtual pet.

- On starting, the software checks whether a saved virtual pet from a previous run is present in the EEPROM.
 - If a saved virtual pet is present, the software offers the choice between loading the saved virtual pet and starting with a new virtual pet.
 - If no saved virtual pet is present, a new virtual pet is started.
- As its default behaviour, the software displays all the statistics of the virtual pet (see next point) on the LCD. The exact way of displaying these is your choice.
- The virtual pet has the following statistics:
 - *Development stage*, which is 0 (egg), 1 (young), or 2 (adult).
 - *Happiness*, which is 0 (unhappy), 1 (content), or 2 (happy).
 - *Fullness*, which is 0 (ravenous), 1 (hungry), 2 (peckish), 3 (full), or 4 (overfull).
 - *Age* (the time since this virtual pet was started, in minutes and seconds).
- Starting values for the statistics are development stage 0, happiness 2, fullness 3, age 0 minutes and 0 seconds.
- When age reaches 5 seconds, the development stage is set to 1, and the following rules are applied:
 - Every 7 seconds, happiness is reduced by 1 (minimum 0).
 - Every 11 seconds, fullness is reduced by 1 (minimum 0). If fullness reaches 0, happiness is set to 0.
- If the development stage is at least 1, the user can perform the following actions with the buttons on the LCD keypad shield:
 - Feed the pet:
 - If fullness is less than 3, increase it by 1.
 - If fullness is 3, increase it by 1 and set happiness to 0.
 - Play with the pet: If happiness is less than 2 and fullness is at least 2, increase happiness by 1.
 - Grow the pet: The development stage is set to 2 if the age is at least 35 seconds, happiness is at least 1, and fullness is at least 3.
- Using buttons on the LCD keypad shield, the user can also enter a menu that offers the following functionality:
 - Save the statistics of the current virtual pet to the EEPROM and stop running. (This may overwrite another save, if it exists. You do not need to be able to save more than one pet.)
 - Delete the saved virtual pet.
 - Start a new virtual pet.
 - Leave the menu (return to default behaviour).
- Optional feature: While the user is in the menu, the simulation is paused (i.e., the countdowns for fullness and happiness are stopped, and the age does not increase).

- You can decide how you handle cases where age exceeds 9 minutes and 59 seconds. (For example, you can decide that the simulation ends, or that age does not increase after this point.) This allows you to exclude cases that make the design and implementation of the display and the save and load functionalities needlessly hard.

Assessment:

Coursework type: individual coursework.

Submission: Week 11, details will be announced soon.

Your submission also needs to include your report in its source format (Word, or LaTeX etc), source codes of your implementation, and simple instructions. You also need to include a video recording of your demo to demonstrate each of above functions.

Demo time: 5 minutes per student, in week 11, exact time and further details will be announced later.

Report: The report should not exceed 3000 words (not counting code, which can be included in an appendix.)

Grading scheme

Most marks are expected to fall into a scale between 40 (“scraped pass”) and 80 (“impressive”). These are explained in the grading descriptors below.

To obtain higher marks, include impressive extra features or implement features in a way that is particularly impressive.

Report (30% of the module marks):

The report should describe the design of the system, its implementation, and all testing steps that have been performed. It should also contain at least one flowchart, finite state machine, or other diagram that describes the behaviour of the system.

- A (80) - The report is comprehensive, coherent and well-structured with all decisions/actions fully justified and evaluated.
- B (70) - A full report has been produced though in places it could be better structured and more comprehensive and coherent.
- C (60) - A full report has been produced though its structure is not always clear. Parts are not as comprehensive or coherent as it should be.
- D (50) - The report covers all aspects of the project though only to a minimal level. Some explanations are not as clear as they should be and the report could be better organised.
- E (40) - Explanations are superficial and the report is disorganised.

Demo (70% of the module marks)

Design (40% of the demo marks):

This partial mark judges whether the project includes all features that are required according to the specification.

- A (80) - All features from the specification have been realized at an excellent level. Additional features are also present.

- B (70) - All features from the specification have been realized at a level that is at least adequate. Some features are excellent or additional features are present.
- C (60) - All features from the specification have been realized at an adequate level.
- D (50) - Most features from the specification have been realized at a mostly adequate level.
- E (40) - Sufficiently many features have been realized at a somewhat adequate level.

Usability (10% of the demo marks):

This partial mark judges whether the software is intuitive to use.

- A (80) - The interface is highly intuitive.
- B (70) - The interface is easy to understand and requires almost no explanation.
- C (60) - The interface is easy to understand after some explanation.
- D (50) - The interface can be understood with some effort.
- E (40) - The interface is not intuitive and requires significant explanation.

Implementation (50% of the demo marks):

This partial mark judges whether the implementation is of high quality and whether all features have been tested thoroughly. This also includes things like avoiding crashes or flickering on the display.

- A (80) - The project is the culmination of a full design process with the implementation carried out at a high-quality level.
- B (70) - The project implementation and testing have been well executed with some aspects at an excellent level
- C (60) - The project implementation and testing have been achieved at an adequate level.
- D (50) - Enough has been done, but nothing is very exciting and the overall achievement is mediocre.
- E (40) - The overall implementation and testing of the project is rudimentary.