University of Moratuwa
Faculty of Engineering
Department of Electronic & Telecommunication Engineering
EN1093 Laboratory Practice - I

# Group Project - Alarm Clock

B.Sc. Eng., Semester 2 2019 Batch

## 1 Task Description

Your task is to design and implement an alarm clock. The user should be able to set the current time and multiple alarms throughout the day. At least 5 alarm tones should be available as choices. It is recommended to have the following modes as a nested menu:

1. Set current time
2. List the existing alarms
3. Change or delete an alarm
4. Set a new alarm
5. Select an alarm tone (eg - Game of Thrones / Pirates of the Caribbean)
6. Factory reset

Your group must develop a unique solution and present it as a complete product. Your product should consist of a 3D printed enclosure and a PCB that may contain:

1. A micro-controller (eg- ATmega328P)
2. A Real Time Clock (RTC) IC (eg- DS1307 or DS3231)
3. A keypad
4. An LCD display (eg - 16x2 character or any other)
5. Buzzer / Speaker

## 2 Evaluation

Each member would develop a complete micro-product and contribute to the full product as well. Evaluation of individual micro-products and the full product will be done in three stages:

1. Micro-product simulation (individual)
2. Micro-product demonstration (individual)
3. Evaluation of the individual responsibility in final product development (individual) and final product demonstration (group)

For stage 1 evaluation, Ardunio C++ can be used. For stage 2 and 3 evaluations, AVR C++ should be used. You must use a version control system (eg. git) and push your own individual code and project files, with meaningful commit messages to a share private online repository and merge them when necessary. Kindly note that remote git history is immutable (cannot be modified). Do not reset your repository or delete commit history.

The immutable commit history (timestamp and authorship of individual commits) of your public repository, from the beginning of the project will be evaluated to ensure fair work division and good project timeline.

The objective of evaluation is to ensure that each member gets the full experience of embedded programming, simulation, enclosure design, PCB design & soldering, and also gains the experience of being part of a collaborative product development process. Therefore, each member will be evaluated for the following two responsibilities.

## 2.1 Individual micro-product development

Each member must individually develop a subsystem of alarm clock into a simple, but complete and independent micro-product and demonstrate its functionality. Kindly note that these micro-products themselves are independent from each other. They will not be assembled into an alarm clock and will not be required after stage 2 individual evaluation.

Possible subsystems are:

1. Key Input: Keypad, microcontroller, power regulator, LEDs
2. Menu Display: LCD, microcontroller, power regulator, buttons
3. Alarm Timing: RTC, microcontroller, LEDs and buttons
4. Audio Output: Buzzer/speaker, microcontroller, buttons

**Example micro-product**

For example, the member choosing to develop Audio Output subsystem into a micro-product is expected to do the following.

1. In a simulator (Proteus), make a schematic with a buzzer/speaker, microcontroller and a power regulator. Write Arduino code and demonstrate its functionality in simulation: playing different tones at a button press. (stage 1 evaluation)
2. Rewrite the code into AVR-C++ and into functions with good APIs (for later integration into full product) packaged into a library: .cc file for source code, .h file for function headers. (stage 2 evaluation)
3. Design a PCB for this simple micro-product, get it manufactured.
4. Design a simple solidworks enclosure for this PCB and battery.
5. Solder components into the PCB, test and assemble with 3D-printed enclosure into a micro product. Demonstrate the functionality of a buzzer playing different tunes at a button press. (stage 2 evaluation)

### 2.2 Collaborative product development

In addition to writing libraries for their subsystem, each member of the team will choose a significant responsibility in developing the Alarm Clock into a complete product, and will be evaluated on that. Possible responsibilities are:

1. Firmware development: use the libraries developed by each member to write the firmware using AVR C++
2. Enclosure design: Design an enclosure for the alarm clock using solidworks
3. PCB Design: Design a PCB, integrating all components
4. Assembling & Documentation: Solder the components and test hardware functionality

## 3 Submission Details

You are expected to submit a report with block diagrams, schematics, PCB layouts, flowcharts, screenshots of simulation, CAD drawings and photos of micro-products and final product. You can attach your code (libraries and integrated firmware) at the end of the report. You are free to use MS Word, but LaTeX is preferred.

## 4 References

1. Online LaTeX editor: Overleaf
2. Simulation software: Proteus 8.9 or higher