ECE 299 Project expectations, constraints & rubric

Project expectations:

Working in teams of two[1],

1. Design and develop a prototype of an *animal themed* clock-radio that has the following functionalities.

   Clock functionalities

   - Set/Edit time through a user interface
   - Set/Edit alarm time through a user interface
   - Display time in 12-hour/24-hour format as desired by the user
   - Trigger alarm as set by the user
   - Snooze alarm & turn-off alarm through a user interface

   Radio functionalities

   - Tune to at least one FM radio channel through a user interface
   - Play radio output on to a speaker
   - Volume control of audio output through a user interface
   - Display radio channel info to the user

2. Design a two-layer printed circuit board (PCB) for the clock-radio and get it manufactured from a commercial PCB manufacturer.

3. Solder the components on to the manufactured PCB.

4. Design and manufacture an *animal themed* enclosure for the clock-radio.

5. Present the clock-radio packaged in an *animal themed* enclosure by the last week of labs[2].

6. Submit a report[3] detailing the design activity.

Project constraints:

The project must be completed subject to the following constraints:

1. Only one Raspberry Pi Pico W must be used as the microcontroller for all information handling and decision-making.
2. The clock display should also be capable of displaying the radio information. The display must communicate with the Raspberry Pi Pico W through SPI protocol.
3. The Raspberry Pi Pico W must be programmed in MicroPython.
4. The team members must be from the same lab section.
5. The project will cost you money.

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[1] In some circumstances, a team of three will be permitted.
[2] Last week of labs might be different from the last week of classes. Please check with the instructor.
[3] One report per team is expected.

Project support:

To facilitate on time project completion, the following support systems are put in place.

1. Components needed for the clock-radio are available for purchase from ELW B320. The component list and the corresponding price is uploaded on Brightspace.
2. Weekly lab sessions will introduce you to different skills needed for the project. These labs will act as a starting point. You are expected to spend time beyond the scheduled lab hours to gain proficiency.
3. Lab space ELW A359 will be accessible to you from 9 AM to 5 PM on all working days. The lab space will have soldering stations, electronic test bench and PCs with all the necessary software.
4. Video tutorials and workshops will be held throughout the term focusing on different skills.
5. A few commercial PCB manufacturers are identified for your convenience.
6. Some parts of the code necessary for the project completion will be provided.

Marking rubric:

Incomplete or not meeting expectations – 0 to 50% of the marks

Below expectations – 50 to 70% of the marks

Meeting expectations – 70 to 80% of the marks

Exceeding expectations – 80 to 100% of the marks

Project expectation	**Incomplete or not meeting expectations**	**Below expectations**	**Meeting expectations**	**Exceeding expectations**
Power supply	Not applicable.	Not applicable.	Powered from the USB port of the Pico using an available source of DC power such as a laptop port, a mobile phone charger etc.	Powered from replaceable or rechargeable batteries through an appropriate regulation circuit.
User interface for the clock part	Cannot set or edit time and alarm in a proper way (i.e. bouncing effect is not overcome).	Can set and edit time/alarm in a proper way (no bouncing effect). However, the interface requires a lot of hardware (more than 4 buttons and 2 encoders).	Can set and edit time/alarm in a proper way (no bouncing effect). The interface requires reasonable hardware (up to 4 buttons and up to 2 encoders).	Can set and edit time/alarm in a proper way (no bouncing effect) using reasonable hardware interface **and** software interface such as a mobile app or a web interface.
Set/Edit time through a user interface +	Appropriate time cannot be set due to poor design. Or inappropriate time can be set	Process is cumbersome and time consuming. Need a lot of inputs to correct a small error.	Reasonably user friendly and not too time consuming. Correcting errors is easy.	Extremely user friendly and rapid. Correcting errors is easy.

Set/Edit alarm time through a user interface	due to poor design.			
Display time in 12-hour/24-hour format as desired by the user	Cannot switch between time formats.	Cannot consistently switch between the two formats. Can accurately display time only in one format.	Can display time in either format. Clear indication of the time format displayed.	Provides additional information such as time zone or displays another time zone time.
Trigger alarm as set by the user	Alarm does not trigger as set.	Radio static or radio station as alarm.	Audio alarm using a specific tone. During alarm, radio should not play.	User customizable alarm sound. During alarm, radio should not play.
Snooze alarm & turn-off alarm through a user interface	Snooze function is not implemented. Alarm can be turned off only after the alarm time is elapsed.	Can snooze only once. Radio does not play while the alarm is snoozed. Alarm status is not indicated. Alarm can be turned off at any time.	Can snooze any number of times. Radio can play while alarm is snoozed. Alarm can be turned off at any time. Alarm once turned-off needs to be set again. Clear indication showing alarm status.	Can snooze any number of times. Snooze duration is optionally customizable through user interface. Radio can play while alarm is snoozed. Alarm can be turned off at any time. Alarm is automatically set to the same time initially set. Clear indication showing alarm status.
Tune to at least one radio channel through a user interface	Cannot play any radio channel.	Can only play one radio channel.	User can tune to more than one radio channel from multiple options. User selection is possible only through the hardware interface.	User can tune to more than one radio channel from multiple options. User selection is possible from both hardware and software interfaces.
Play radio output on to a speaker	Extremely distorted or feeble.	Distorted audio. Radio can be heard only at specific times.	Radio can be heard any time. Sound quality is reasonable.	Radio can be heard anytime, and sound quality is excellent.
Volume control of audio output	Volume cannot be controlled	Volume can be increased or decreased but only	Volume can be increased or	Volume can be increased or decreased for radio

through a user interface	through user interface.	in a unidirectional manner.	decreased easily for radio. Only hardware user interface facilitates this.	and alarm. Mute option is available for radio. Hardware and software user interface allows volume control.
Display radio channel info to the user	No information about radio channel is displayed.	Displays only the frequency of the radio channel.	Displays the radio channel frequency of the tuned channel and the current volume level.	Displays radio channel frequency, volume level, channel name etc.
Printed Circuit Board (PCB)	No PCB. Or PCB has multiple issues and hence is not working as expected	PCB has a couple of issues. However, upon fixing them the PCB works as expected.	PCB has no issues. PCB works as expected. Size of the PCB is more than 30 cm^2.	PCB has no issues. PCB works as expected. Size of the PCB is less than 30 cm^2.
Enclosure	Does not fit the clock radio properly. Poor finishing and unappealing look. There is no theme.	Poor finishing, unappealing look. Proper fit. The theme is not easy to relate. Enclosure shape is conventional.	Decent finishing, proper fit and appealing look. The theme is easy to relate. Reasonably creative enclosure shape.	Excellent finishing, perfect fit and attractive look. The theme is prominent. Highly creative enclosure shape.