Principles of Embedded Software
Final Project Proposal (Spring 2021)

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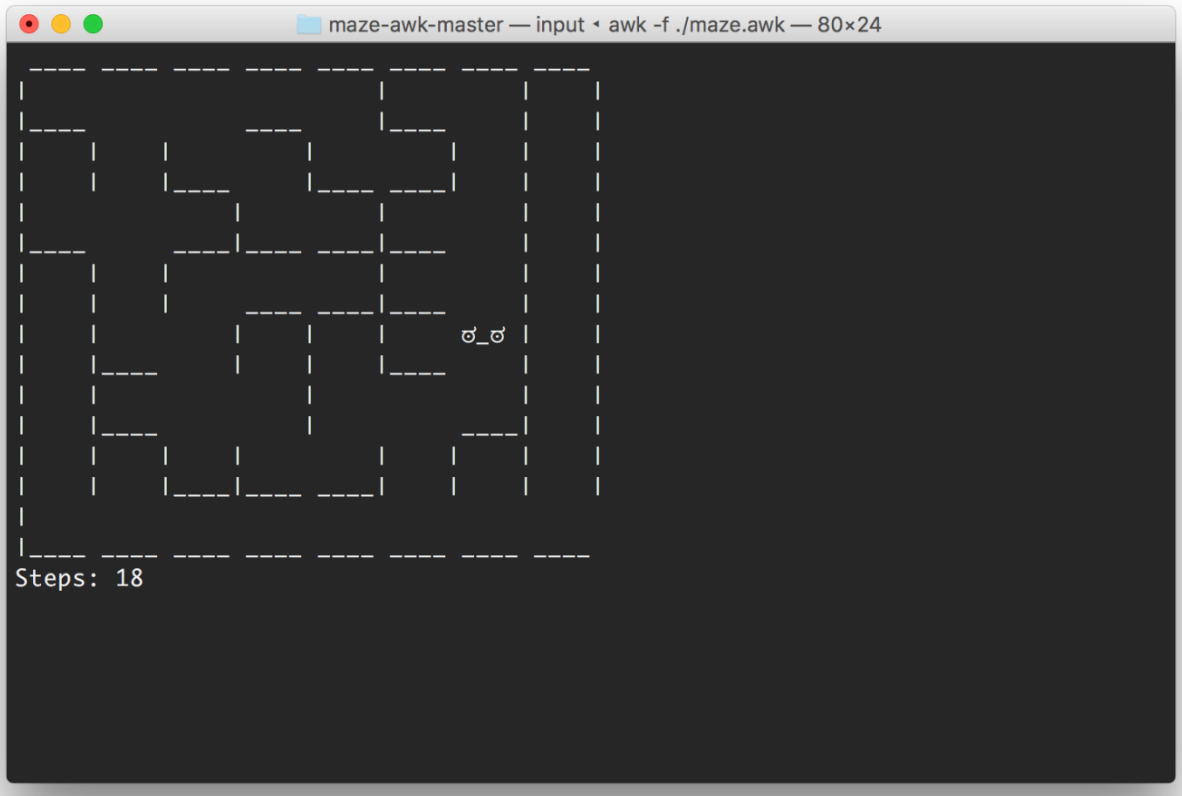
Project Outline and Vision

To develop a terminal-based Maze game using the on-board accelerometer (MMA8451Q) to move a cursor through the maze. The accelerometer will be used to gauge the movement of the cursor and the terminal screen will be updated over UART. This movement of the cursor must be flexible enough such that it can move across the terminal screen and tuned with the accelerometer so that movements are smooth. The game may include 1 or more levels for the user to play. The capacitive touch may also be tied in to provide a button input for the user to make selections such as to start the game or exit the game. I intend to have a startup screen for this purpose before the game starts.

To provide a brief idea of what it would resemble*, it might look something like this:



Source : https://github.com/taravkov/maze-awk

*Image only for representative purposes

Technologies to be Used

- UART - To print the game to a PC using a terminal emulator.
- I2C - To communicate with the accelerometer to receive movement inputs.
- Circular Buffers & Command Processing - To send and receive data over UART. Command processing may not be used extensively.
- Interrupts - For the UART and I2C handlers.
- TSI Interface - To receive inputs from the user during the game.
- State Machine - May be required, not a necessity (Open ended).
- Test framework - Will most likely use a hybrid approach. Test functions will be automated wherever possible. Uc Unit can be used for a framework as it is straightforward.

Learning Required

- Understanding how to interface the accelerometer and obtain raw data.
- Processing the raw data into meaningful movements, possibly by averaging out the data.
- Ways in which a maze can be generated and printed on the terminal.
- Controlling the cursor position on the screen by interfacing it with the accelerometer. This will also require some knowledge of ANSI Escape Codes (So that I can freely move the cursor around the terminal, change colors etc.)
  This will possibly consume the most time as I will need to track and update the cursor positions relatively fast.

References Required

- KL25Z Reference Manual
- Tera Term Supported Control Functions
- ANSI Escape Code
- MMA8451Q Datasheet
- uC Unit Test Framework
- uC Unit Tutorial
- Previous assignment code references

No additional hardware would be required for the project.

To check the feasibility of moving a character around the terminal window, I modified the BreakfastSerial assignment code to check if I could send escape codes from the device to the terminal to control it. This seems to be possible and working, a screenshot is attached below.

test - Changed the background color to yellow.
up - Moved the cursor up 7 rows, to the right 6 columns and printed a *

Testing Strategy

I will write manual test cases to compare expected and observed values and unit test the individual functions. uC Unit can be integrated into the code to provide a test framework. For testing the system functionality, it will have to be through visual comparison of the expected and observed result. I would appreciate any comment regarding how I could test the system in a better and easier way if possible.

Conclusion

The proposal outlines the approach to develop a maze game on a terminal emulator along with the technologies that will be used and the knowledge required. Any feedback or comments regarding the issues I may face, gaps in my understanding or regarding software complexity would be highly appreciated.