

Project Report: Numerical Analyzer and Function Plotter

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1 Introduction

In this project, we have made a simulator to analyze different numerical methods. The features are -

- Acting as scientific calculator
- Gaussian Elimination
- Newton Raphson
- Simpson's Integration
- Graph Plotting

All of this features include simulation according to user's input.

2 Circuit Diagram

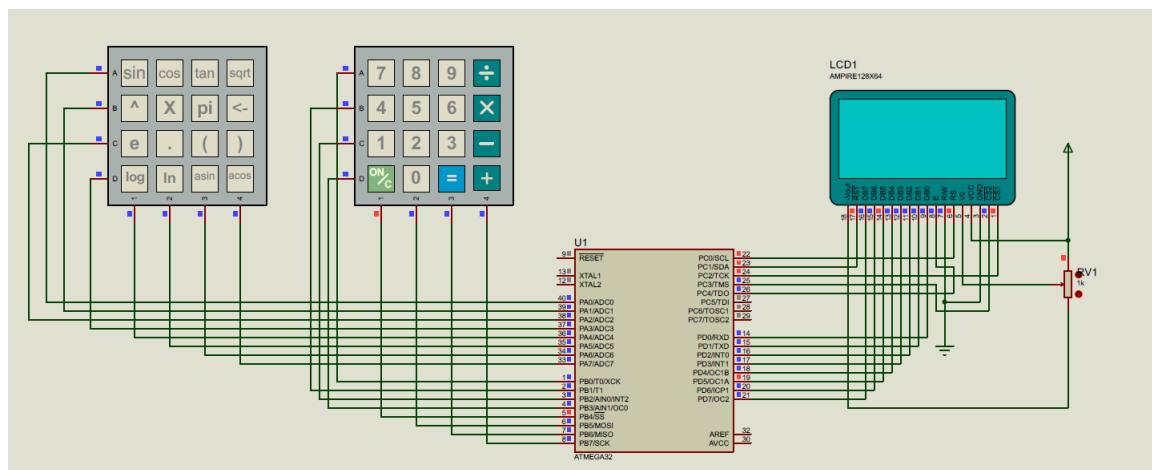


Figure 1: Circuit Diagram

3 Components

The components we used are —

- Atmega32 microcontroller
- 2 Keypads (4×4)
- 128×64 Graphical LCD

It has 128×64 pixels. It has 8 data pins. It has two halves horizontally i.e. total two 64×64 parts. Each part is divided into 8 equal pages and each page has 8 rows. So, in the base level, each row has 64 pixels. With addressing, we can turn on or off an exact pixel and show anything on the screen.

Apart from data pin and part selection pins, it has usual pins such as, V_{cc} , GND, enable pin etc.

The library we used for it has the functionality of writing letters/digits, turn on a pixel and clearing the screen.

4 Difficulties

We faced some difficulties while implementing the whole project —

- The main difficulty was with memory usage. Atmega32 has only 2 KB data memory. As our project was based on simulation and graph plotting as per user's inputs, it asks for extra memory. We had to optimize our code to solve this issue. Some of them are –
 1. We did not allocate variable or arrays for storing values of intermediate steps of calculation. Rather we tried to derive values in an inline manner. It made our code a bit complex to read, specially for graph plotting.
 2. For static and constant values, we tried to store them in EEPROM. This can be done by declaring variable like '*PROGMEM static const char **var-name***'.
- Interfacing and using 128×64 GLCD were complicated. Its library is quite scartch. However, the library we used implements the circuit by connecting pin from 3 different sides (A,C,D). We had to edit it so that we can interface with only consecutive pins from 2 sides.
- For finding values of user input, we had to use parser. In some features, user inputs function. This texts may include functions like sine, cosine, exp and may have some level of parentheses. We used such a parser and made some adjustment to it for proper memory usage and error message.

5 Project Link

The link to our project is given below.

<https://github.com/diponsaha007/Numerical-Analysis-with-ATMEGA32>