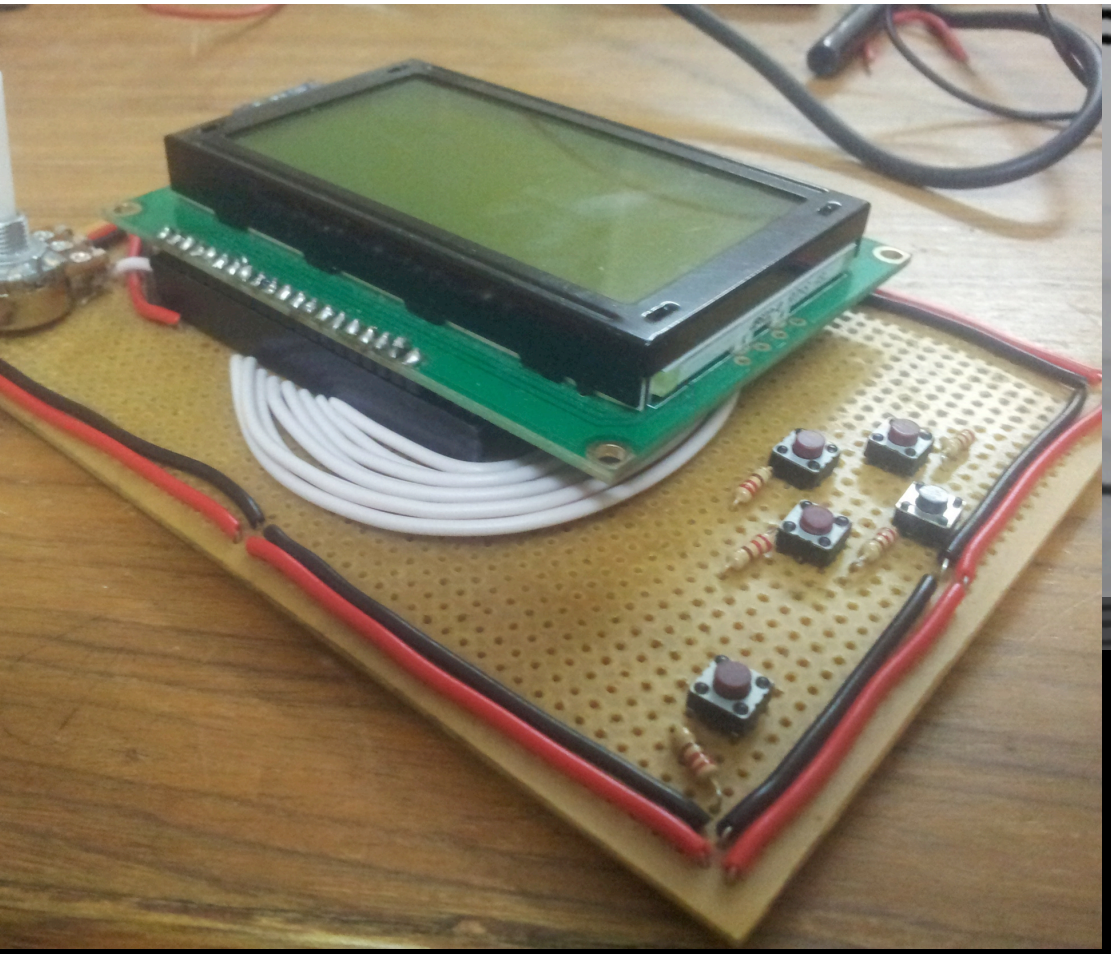
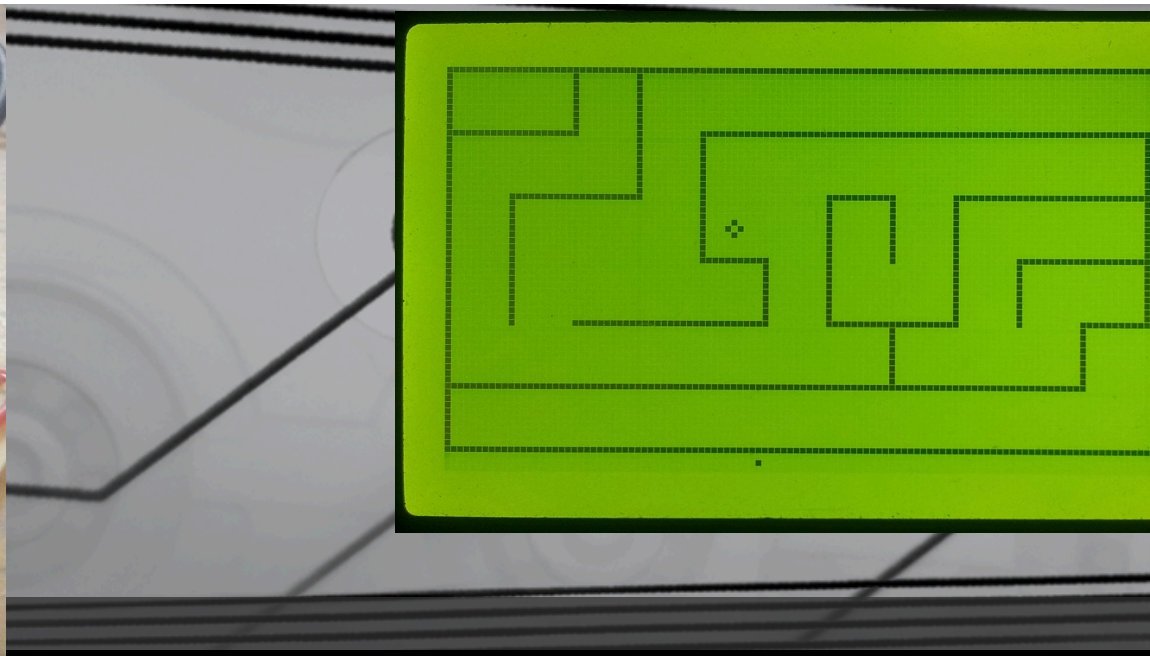
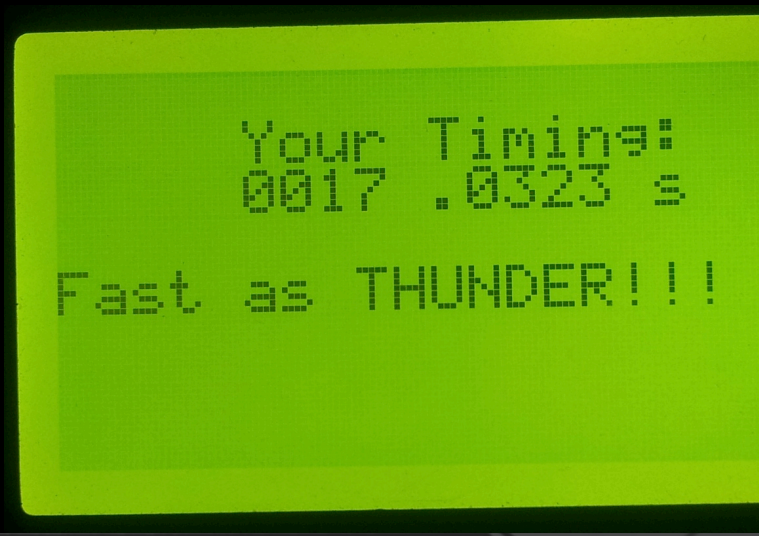




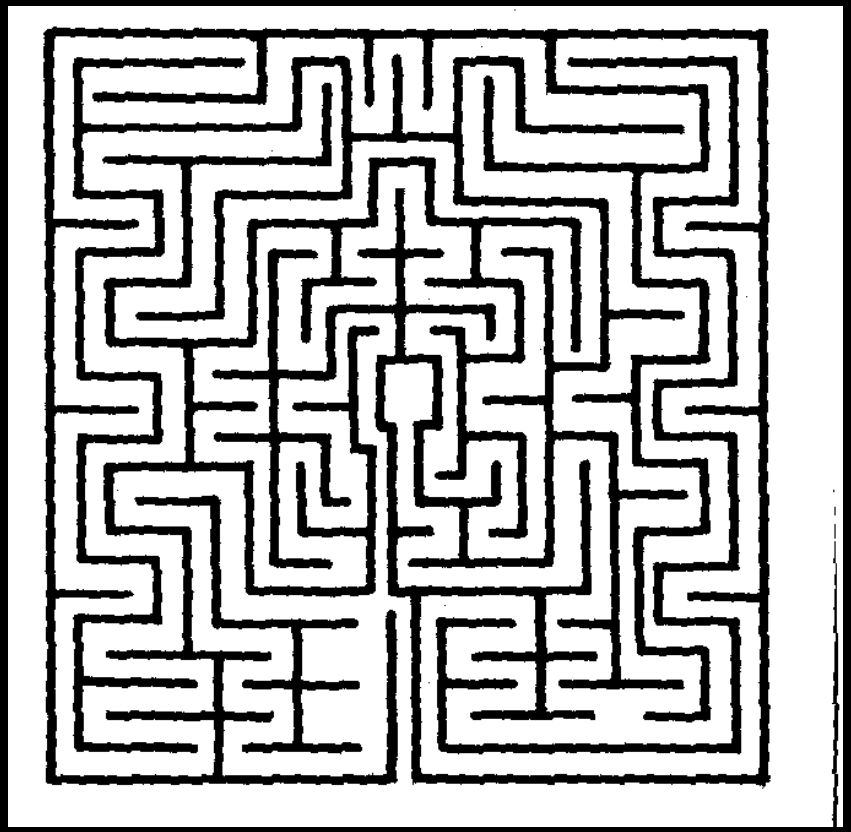


Labyrinth

Team:Big Nugget

Introduction

Everyone of us must have played labyrinth in one form or the other, at some point in our lives.



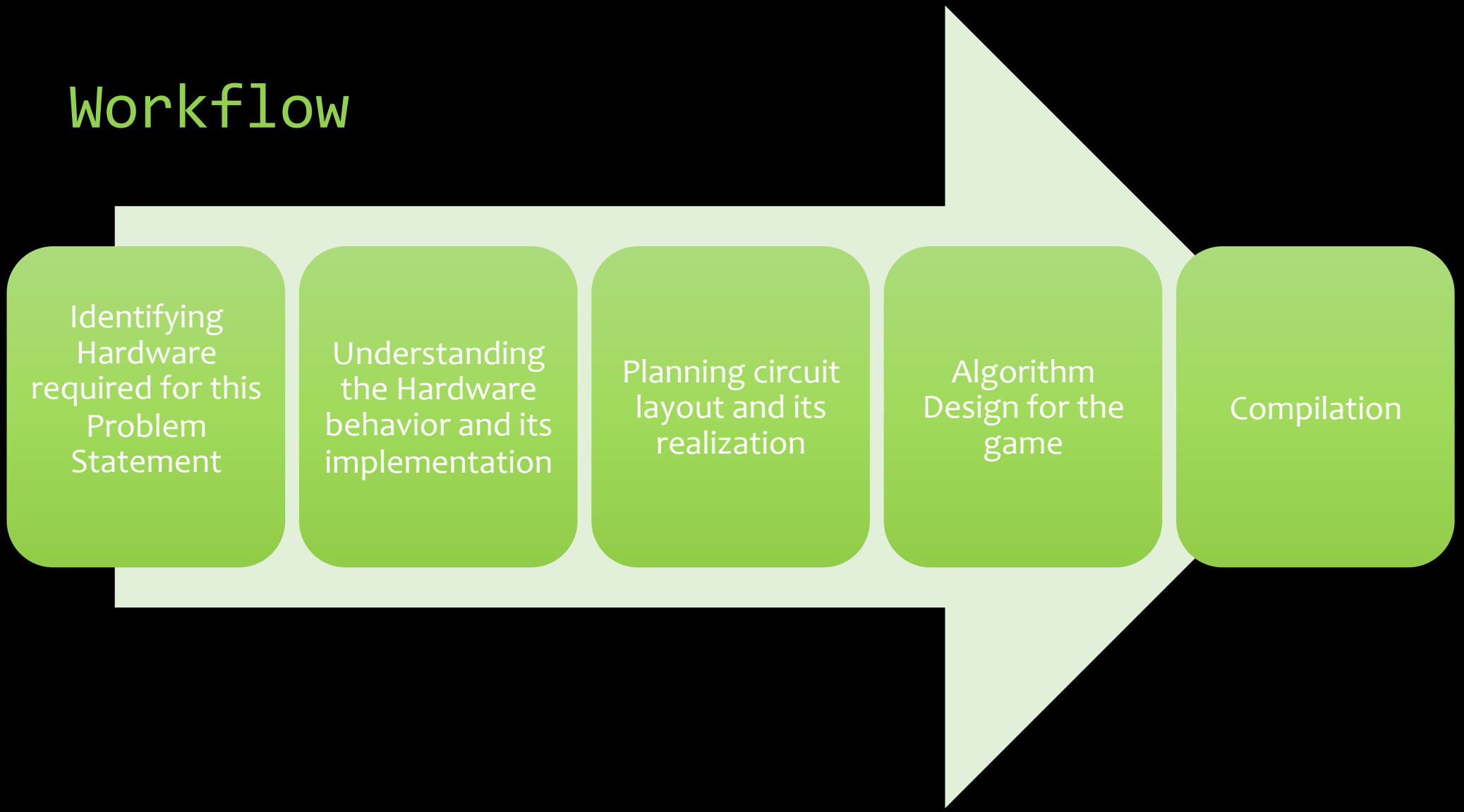
A classic game where the ball has to be taken from one part of the maze to the other by tilting the board.

We have tried to implement this game by using a simple microcontroller.

Extra Features

- An Intuitive GUI, which gives a more easy way for the first time users to navigate.
- Multiple Maps have been stored in EEPROM.
- A variety of 3 balls have been given for the users to choose from.
- A Pause/Resume feature has been provided.
- The ball moves with variable speed depending on the tilt (i.e. acceleration).
- A feature of rebounding at the walls has also been included in the game.

Workflow


Identifying Hardware required for this Problem Statement
Understanding the Hardware behavior and its implementation
Planning circuit layout and its realization
Algorithm Design for the game
Compilation

Hardware Components

- Atmega 32 (Main processing unit satisfying our memory requirements)
- 3-Axis accelerometer (MMA7361L)- used for detecting the sense of rotation as well as calculating the instantaneous velocity of the ball in the XY-plane.
- Graphic LCD (JHD 12864E) – A 128 X 64 Graphic LCD used as the display for our console.
- Resistors, capacitors and switches to meet the requirements of the circuit, while fulfilling the objectives of the problem statement.

Understanding the Accelerometer

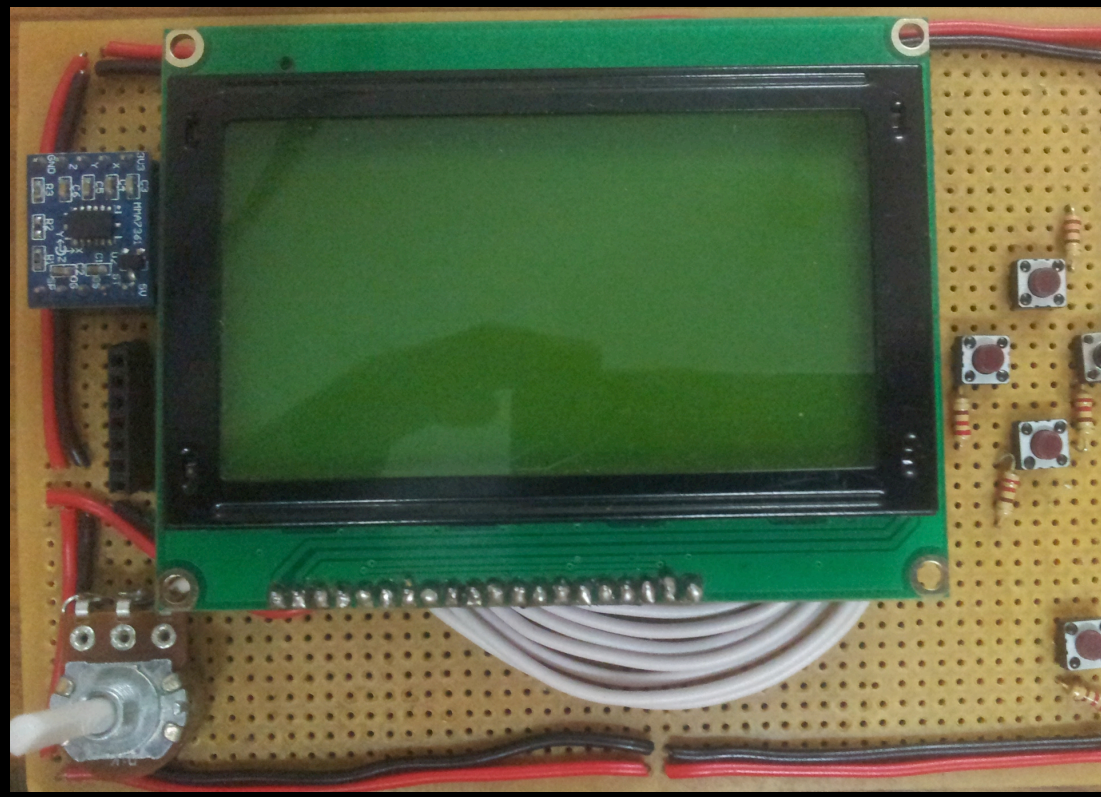
- We used an analog (low-g) accelerometer which gives outputs ranging from 0.85 to 2.45V for –g and +g acceleration respectively.
- The sampling frequency of the accelerometer is 11KHz.
- This analog input is given to Atmega via ADC Pins

Understanding GLCD(128 X 64)

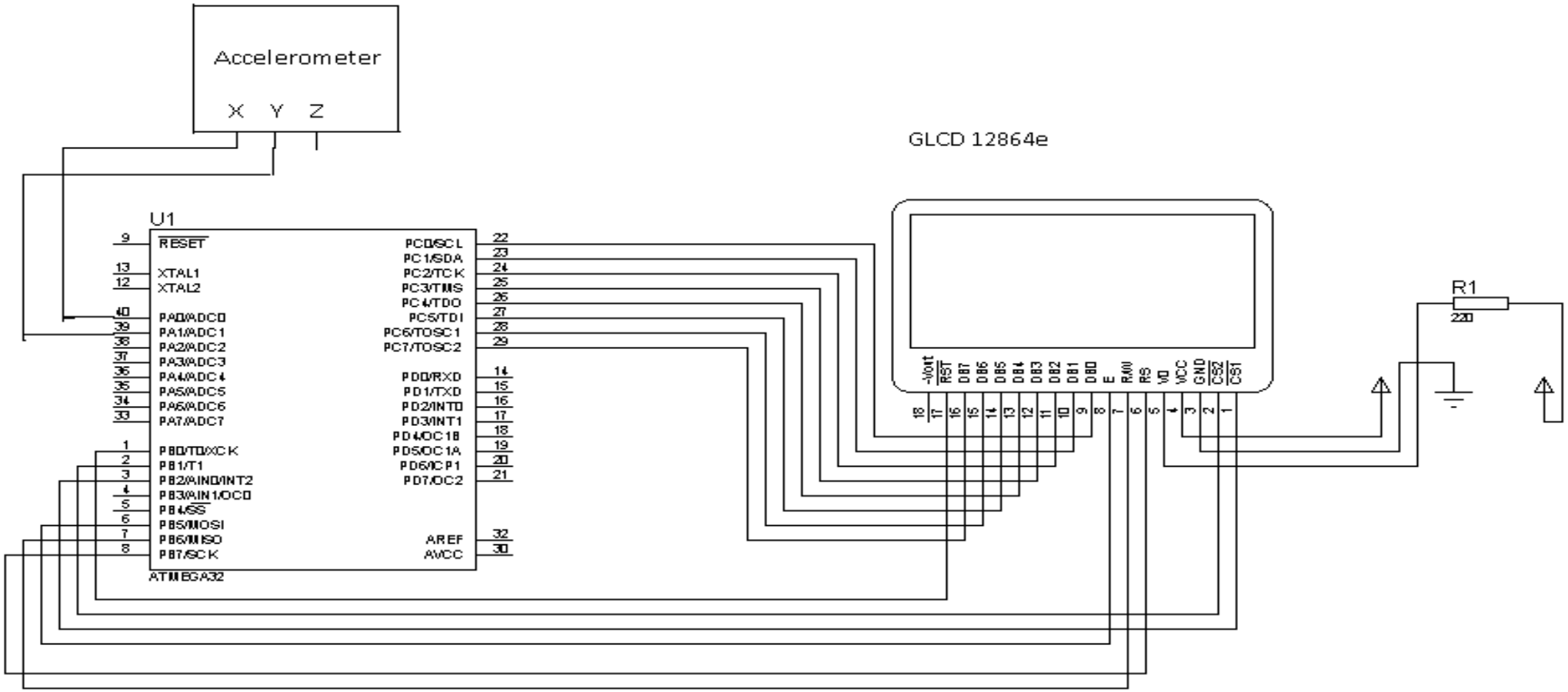
- There are 8 data pins and 6 other pins for the control of GLCD.
- In this particular GLCD we have two KS0108 controllers for controlling each of the 64 X 64 pixel matrix.
- The GLCD provides a voltage of -10V which is fed into the contrast pin through a potential divider, to control the contrast of the GLCD.

Circuit Planning

- The GLCD was placed approximately at the center of the General Purpose Board, to give a better user experience.
- The accelerometer placement is as close as possible to the GLCD to minimize error in the axes of the accelerometer.

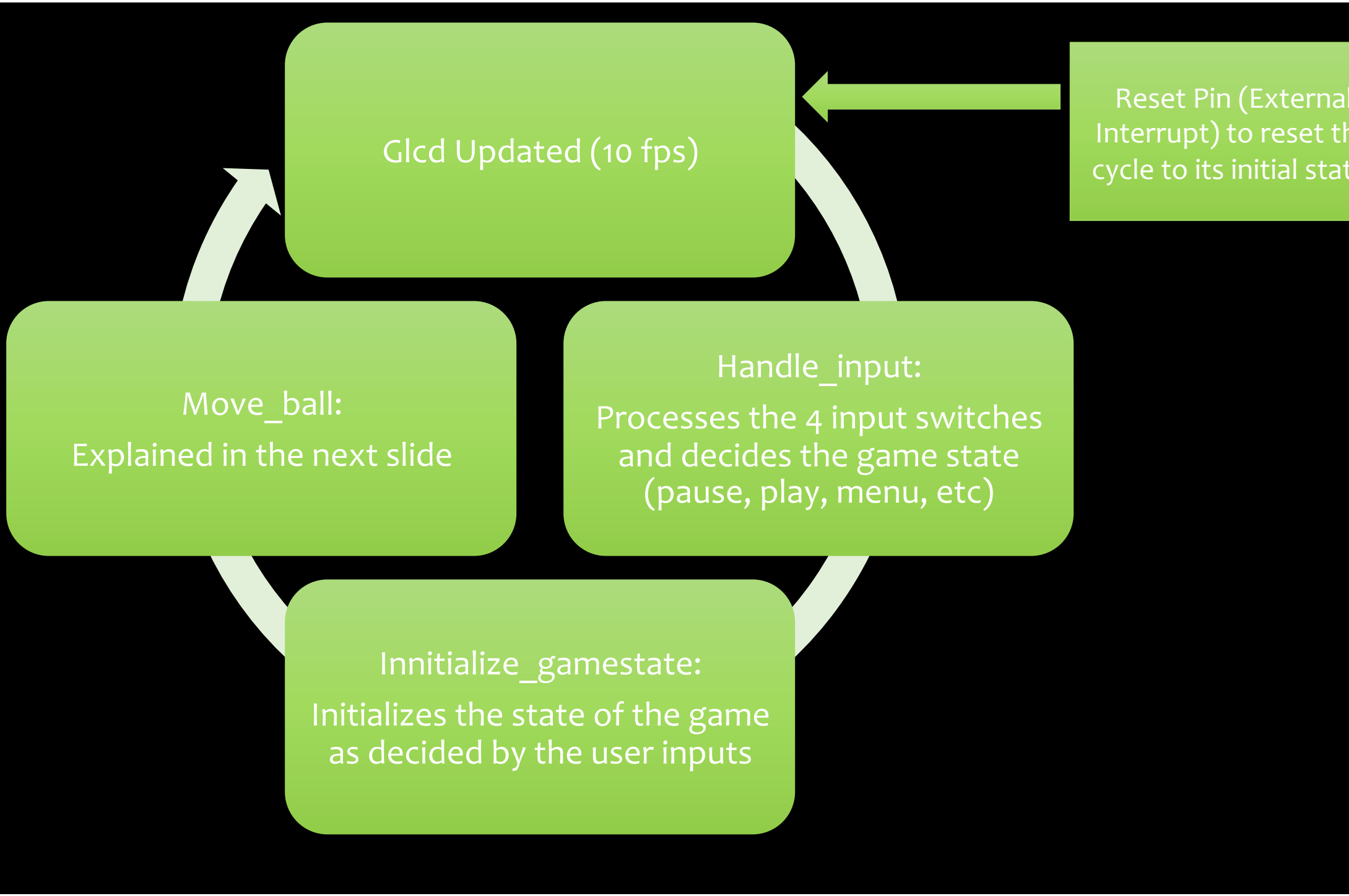


Schematic Circuit Diagram



Algorithmic Design

- Generally PC Games operate at 60 fps and Mobile phones operate at 30 fps.
- To maintain the quality of the game play as well considering the processing limitations we decided to operate the game at 10 fps


Glcd Updated (10 fps)
Reset Pin (External Interrupt) to reset the cycle to its initial state
Handle_input:
Processes the 4 input switches and decides the game state (pause, play, menu, etc)
Innitialize_gamestate:
Initializes the state of the game as decided by the user inputs
Move_ball:
Explained in the next slide

Move_Ball

- Updating the velocity of the ball from the sampled acceleration provided by the accelerometer.
- Virtually moving the ball from its initial to final position, while detecting any collision with the walls in the way.
- If a collision seems to occur, the ball is appropriately stopped before the wall and its velocity changed according to the laws of collision.
- The coefficient of restitution used here is 0.25.

Issues Faced and their solution

- The ADC Registor on Atmega require some time to stablize, when moving from one channel to another.
  - The time taken for the above is created by initializing the registers before the completion of time for one frame.

- Due to existence of 2 controllers in the GLCD, the controllers require some time to initialize as the ball moves from one territory to another. This leads to some error variations in the central line.
  - This problem was solved by using a dummy_line function which prints the actual central line when the ball Is in the vicinity

Estimated Cost

- Atmega 32 – Rs.200
- GLCD – Rs 600
- Accelerometer – Rs.650
- General Purpose Board- Rs. 60
- Other Hardware- Rs 40

Net Cost- Rs 1550