Project Overview
Liquid crystal displays (LCDs) have become an indispensable part of our lives. Over the last few years, LCDs have dominated the market. Low electrical power consumption and slim size of LCDs bring a breakthrough in electronic devices and have created a new era in portable devices. Due to these characteristics, LCDs are used in a wide range of applications such as television, watch, cellular phone, electronic paper and notebook computer, etc.

Aim and Objectives
- discover the factors affecting the performance of the LCDs
- simulate the narrow and the wide viewing angles with different configurations

The objective of the project is to produce different types of switchable viewing angle LCD in order to protect and share information according to the user’s inclination.

Methodology
There are five states in the project:

1. Project specification
   - Identify the goal and direction of the project
   - Determine the objective of the project

2. Research
   - Information gathering
   - Organize the information from relevant materials
   - Hypothesis formulation

3. Simulations
   - Calculation and simulation
   - Analyze and compare the results

4. Optimization
   - Determine and optimize the configurations

5. Results publication

In the LCD optimization, MOUSE-LCD is used to simulate and optimize the performance of LCD.

Results
The acceptable image is limited to the contrast ratio that is greater than 9.

<table>
<thead>
<tr>
<th>Optimization Criteria</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viewing angle in narrow mode</td>
<td>±20 (horizontal)</td>
<td>±20 (horizontal)</td>
<td>±20 (horizontal)</td>
</tr>
<tr>
<td>Viewing angle in wide mode</td>
<td>±80 (horizontal)</td>
<td>±90 (vertical)</td>
<td>±90 (vertical)</td>
</tr>
<tr>
<td>Maximum Contrast ratio</td>
<td>&gt;300</td>
<td>&gt;0.3</td>
<td>&gt;0.3</td>
</tr>
<tr>
<td>Maximum Transmittance</td>
<td>&gt;0.3</td>
<td>&gt;0.3</td>
<td>&gt;0.3</td>
</tr>
</tbody>
</table>

Symmetric in contrast ratio & viewing angle

Figure 1 Two-way Viewing Angle LCD
Figure 2. Do we need to do so if we want to protect our privacy on the screen?
Figure 3 Switchable Viewing angle display
Figure 4 MOUSE-LCD
Figure 5 The levels of contrast ratio
Figure 6 Optimized results of switchable viewing angle display