Embedded Design Challenge – Takneek 2012

Problem Statement

To design and build a music synthesizer with a visualiser.

Compulsory Features

- **Music Keys**: The device must have at least 8 keys that can generate 8 basic notes of an octave.
- **Graphical Visualizer**: The device must have a graphical visualiser attached to it in the form of a glcd which should give a visual representation of the notes played.
- **Pre-Amplifier**: The output from the synthesizer must be amplified to such extent that it can be heard from a speaker.

Additional Features

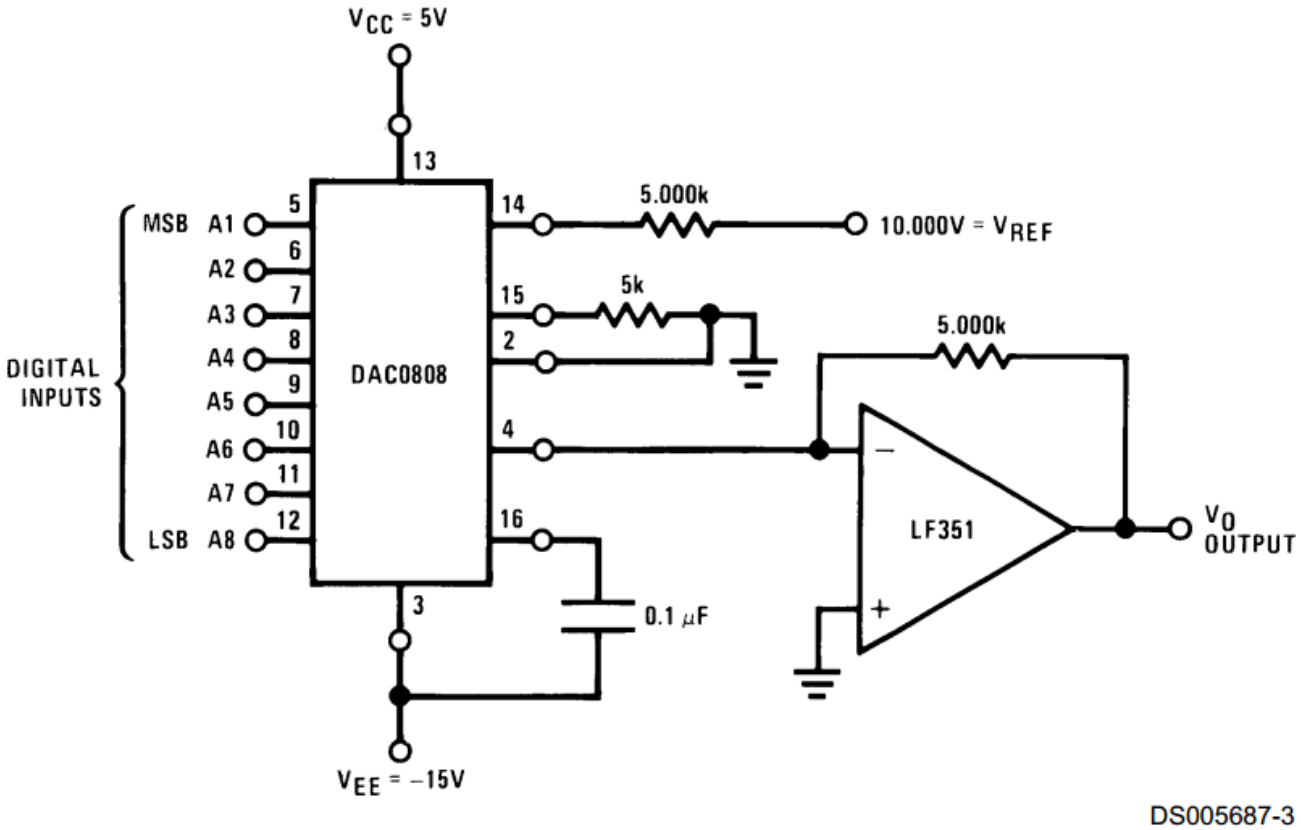
- Control knob to control volume, pitch etc.
- Implementation of Chords (multi key press)
- Representation of volume level , pitch level etc. on GLCD.

Implementation

Sound Generation

- The notes are nothing but sine waves of variable frequencies.
- To generate sine waves from micro-controller we need Digital-to-Analog Converter, DAC0808.
- DAC0808 : 8 digital input pins and 1 analog output pin.

DAC0808



$$V_{out} = \frac{R2}{R1} * V_{REF}\left(\frac{PORTX}{256}\right)$$

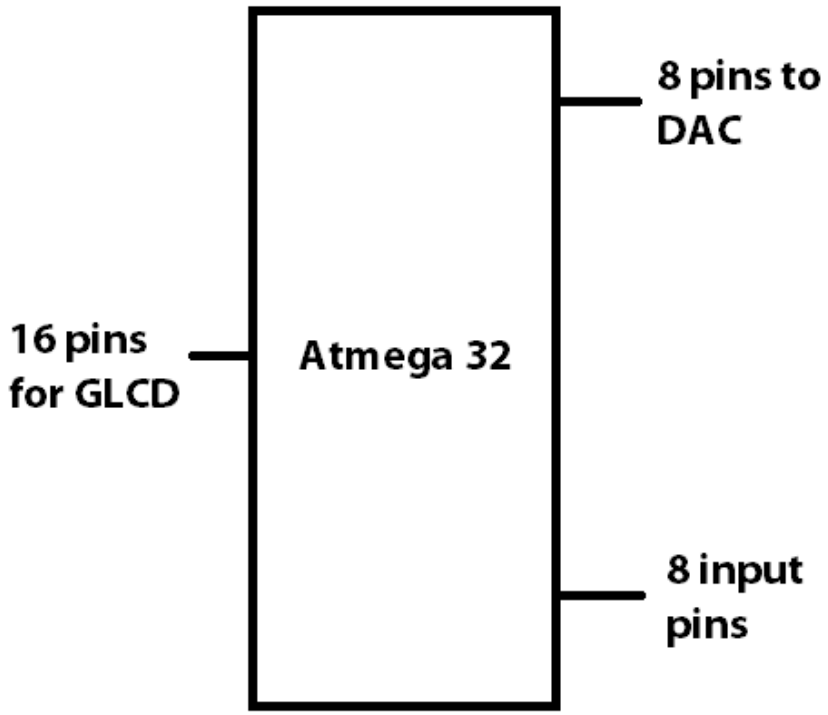
Software Code

- We scale the sine wave from -1 to 1 to 0 255
- Divide one time period of sine wave into 64 parts.
- We create a look up table with the values of sine waves at these 64 instants.
- sine [64] = { } ,
  where sine[k] = (1 + sin(2pi * (k/64))) * 127 ;
- After every T/64 seconds , update PORTX

Graphical LCD

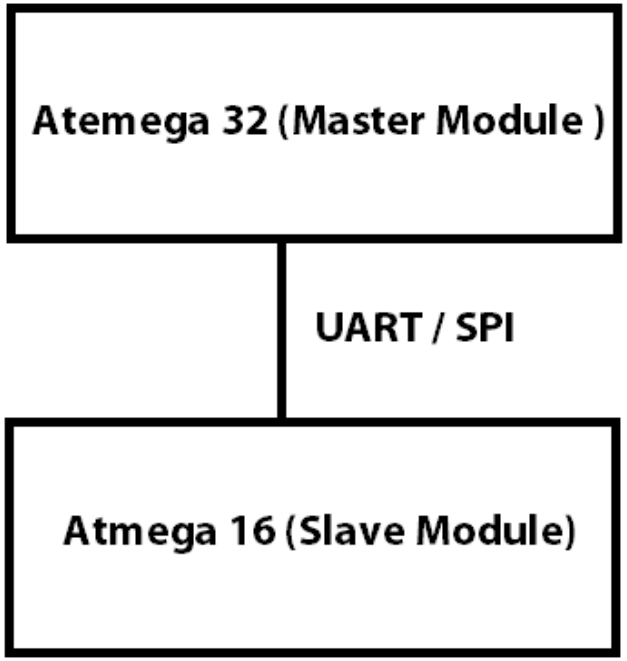
- Two dedicated ports are used to connect to the GLCD.
- Functions similar to character LCD
- The only difference is that in character LCD we can access an alphabet whereas in GLCD we can access individual pixels.
- The GLCD has 128X64 pixels.

Overall Circuit



All pins used …
where to add extra features ???

One way..



Divide the task between two Atmega.

Resources

- GLCD Tutorial - http://students.iitk.ac.in/eclub/database.php > Tutorials

- AVR micro-controller concepts - http://students.iitk.ac.in/eclub/database.php > lectures > summer 2012 lecture series

Rules

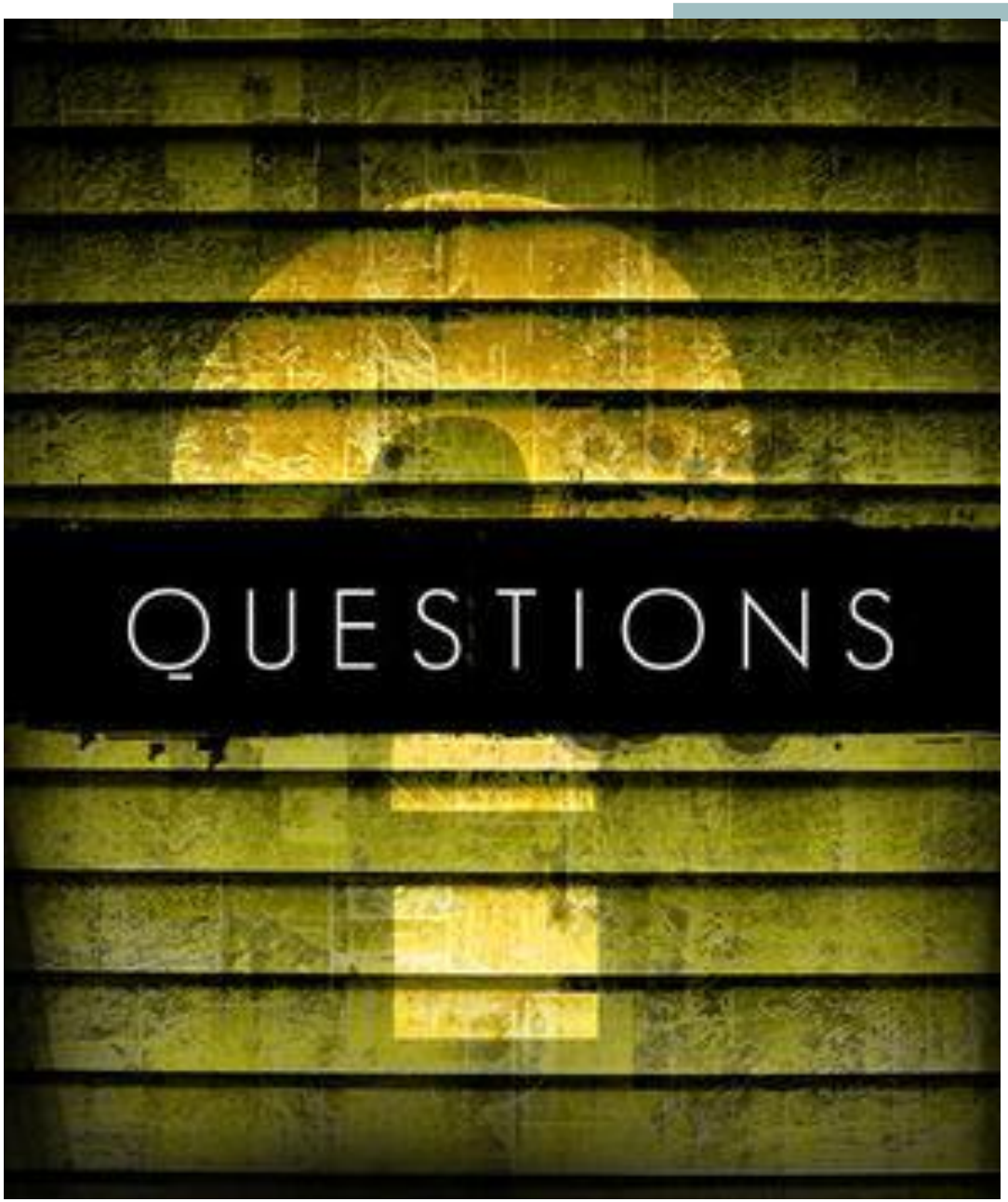
- Students belonging to any batch or program are eligible.
- Team strength should not exceed 3.
- There are no restrictions on number of teams from a pool.
- Teams willing to participate in the event must submit an abstract to eclub.iitk@gmail.com before 20th August, 11:59 pm.
- Based on the abstract top 16 teams would be selected, to participate in the event.

Judging Criteria

Parameter	Weightage (%)
Compulsory Tasks Achieved	20 (5+10+5)
Logic used and software implementation	20
User Friendliness of the device	15
Additional Features Implemented	25
PCB/GPB layout and soldering	10
Presentation	10

Announcements

- Teams willing to participate in the event must submit an abstract to eclub.iitk@gmail.com before 20th August, 11:59 pm.


QUESTIONS

Thank You

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Takneek Website :
http://students.iitk.ac.in/takneek/ > events > Electronics > Embedded

FB Group : www.facebook.com/eclub.iitk