PROJECT DOCUMENTATION

PROJECT TITLE: Arduino Smart-GPU Tablet

TEAM MEMBERS: Shubham Atreja, Subhrajeet Paul, Shubham Sonewane, Shreyash Pandey.

TEAM MENTOR: Shivendu Bhushan, Anurag prabhakar.

BASIC AIM:

To create an arduino based tablet that uses Smart GPU as the display, designing the basic GUI of the tablet and developing the various applications associated with it.

MOTIVATION:

We wanted to make something special and exciting during the summers. So we started with the idea of a plug-in and ready to use tablet. The Coordinators approved the project and stressed on making it a music playable tablet. Hence we were given the Smart GPU which has a DAC of its own. Also, Arduino Due was what we started with, but due to compatibility issues with smart gpu , we Arduino Mega instead.

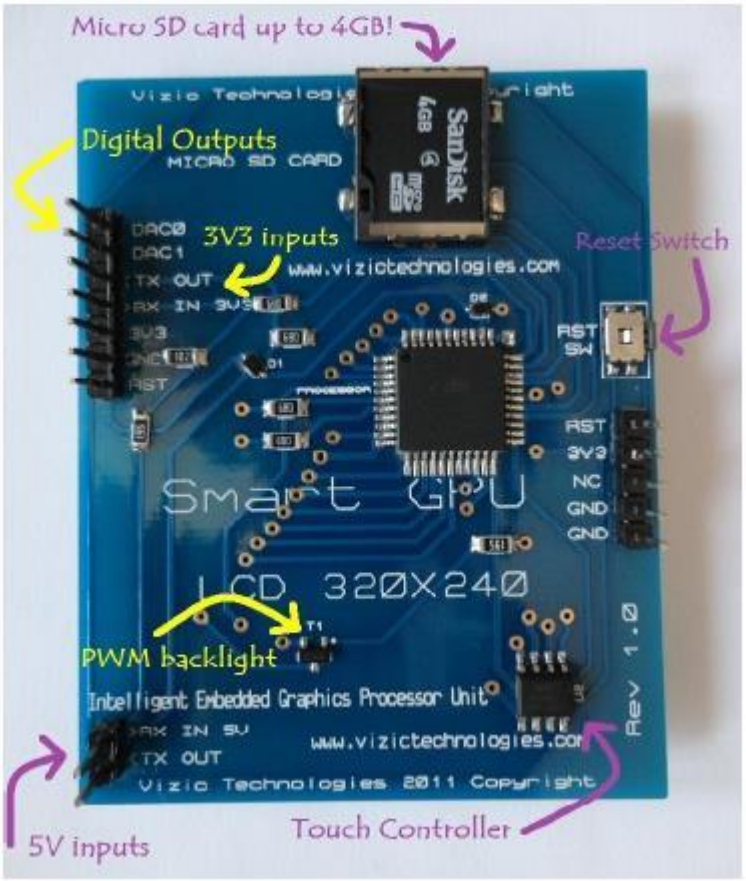
THEORY:

SMART GPU: Intelligent Embedded Graphics Processor

Description:

The SMART GPU is a powerful easy to use embedded graphics processor mounted on a board with a touch color LCD. It's aimed to help developers to create advanced Graphical User Interfaces (GUIs) in a very easy way. Now it features FAT data management functions (Data Logger) to create even more advanced applications in just minutes, not days. The SMART GPU processor doesn't need any configuration or programming on itself, it's a slave device that only receives orders, reducing and facilitating dramatically the code size, complexity and processing load on the master host processor.

SMART GPU-EXPLAINED



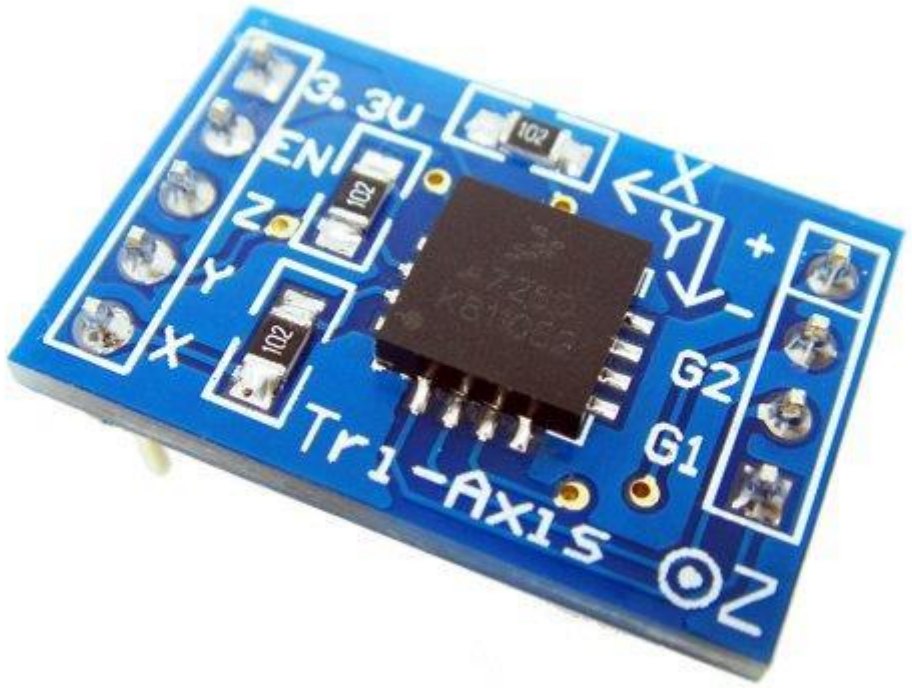
OUR APPROACH

Sensing the touch, Smart GPU provided us the coordinates of the point at which the stilus had made contact with the screen.

Designing the GUI was our primary objective and we achieved that through loading images on the Smart GPU. The SD card slot as shown in the picture above housed the SD card which had all the images which the GPU would display.

So all we had to do was sense the touch and command the arduino to load some other image (if required) or take the program control to some other module of the main code.

Halfway through the summer, we decided to implement a motion-sensing game as well. We used an Accelerometer for the same.



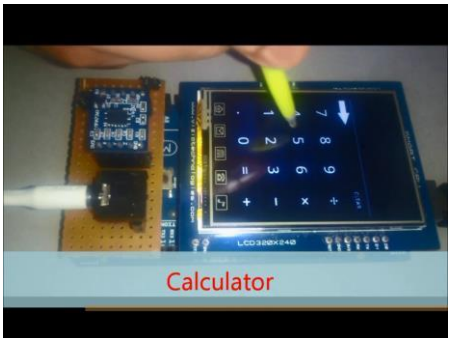
Various problems were encountered while playing music. We got hold of a .wav file and converted it to .txt file. We then stored it in SD card and called it from the code. But various

problems were being displayed while storing the various notes in an array. Solution: File Handling. But then the duration for 4096 notes(stored in the SD card) was not available.
We then decided to implement music in an alternate way. Rather we generated all the 8 bit music that we are supposed to play.

As can be seen from the above image a headphone jack was also used as an output of the played tones.

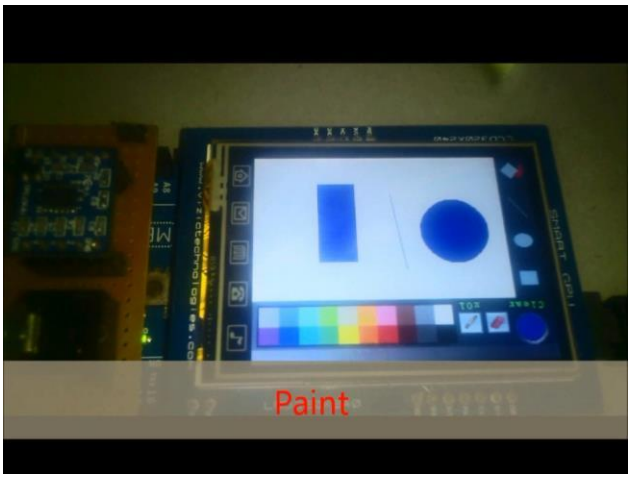
OVERVIEW

Designing the various apps took a lot of effort. For example, calculator image had 18 sensitive areas where each touch would result in a different outcome. Mindless if-else would result in 18 big and hectic blocks of compound statements. We designed an algorithm which used a for loop to do the same. However, debugging this short code took a lot of effort.

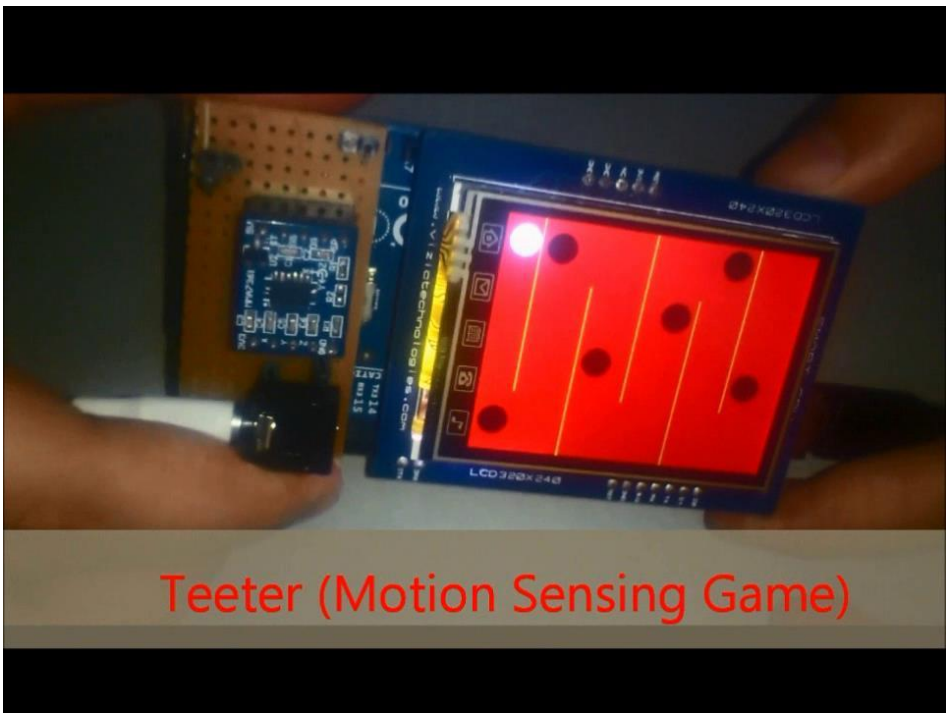


Another such subtle problem was of threading/using interrupts. Games such as DX Ball required Moving the platform and ball simultaneously. But we were lucky enough to have a powerdul processor in Arduino Mega.

Flood Fill in paint was another such subtlety; ordinary recursive algorithm resulted in stack overflow. So, we had to develop our own algorithm using simple loops



Teeter, or the motion sensing game exploiting the accelerometer was probably the most innovative of all the applications. Instead of sensing the holes through coordinates, we used a colour detector function to detect the colour of the centre of the ball and take the action accordingly. This meant making the ball transparent, so what you finally see is actually a ring instead of a ball.



UTILITY

What we wanted to make was a ready to use plug-in tablet and we were successful in creating it. It includes all the daily purpose applications including a calculator, a calendar, an image-viewer, a notepad, few games for entertainment, paint and a music player.

FURTHER DEVELOPMENTS AND SCOPE

1) **Teeter graphics can be improved a lot.**
2) **Instead of playing only 8 bit music, we can use the DAC and play real-time songs.**
3) **We can attach a battery to make the tablet power source independent.**
4) **We can also attach a GSM shield to improve the connectivity of our tablet.**

USEFUL LINKS:

1) Smart-GPU datasheet and basic libraries:
http://vizictechnologies.com/#/smart-gpu/4554296549
2) For all arduino related doubts :
http://www.arduino.cc/
3) Final video of our project:
https://www.youtube.com/watch?v=3zJQrRn7FXQ

A WORD OF THANKS

We would like to thank our mentors Shivendu Bhushan and Anurag Prabhakar for their guidance, patience, suggestions and firm belief in us .
They inspired us to learn a lot and work on this exciting project and checked the progress of our project so sincerely that even if our project was on a standstill, they showed us the way. Moreover, it was fun doing this project in first year summers as we got to learn a lot and we hope to stay in contact with the electronics club for the remainder of our stay at IIT Kanpur.