PROGRESS REPORT

Throughout the past three months, we have nearly managed to complete all the components listed below. We are now at the point where we can begin the integration process while we continue to finish the various separate components.

The musical carpet can be divided into the following components:
- Sensor Module
- Main Control Unit
- Audio Processing Unit
- Pitch Detection Algorithm
- Control/Display Module

Sensor Module

From the beginning of the project until present time the sensors module/carpet has come through several design stages. Currently this module nears completion and is proceeding according to schedule. The carpet has been made from two separate carpets and glued together at the bottom layer. The sensors are implemented in the form of contact switches with foam material acting as a non-conductive spring that separates the metal plates. Soldering of the contacts is 50% done.

Main Control Unit

The main control unit is used to sample sensor switches and send signals to the Audio Processing Unit to play the corresponding sound. This part is completed and has been tested with the switches. Initially, we used the Atmel ATMega32 for the Main Control Unit. However, the ATMega32 has very limited RAM, so when we integrate the pitch detection algorithm into the Main Control Unit, there might not be enough RAM. Therefore, we upgraded the MCU from an ATMega32 to an ATMega128, which has two times more RAM. In addition, there are many more I/O pins than the ATMega32. Now we can connect as many LEDs and switches as we want for the display.

Audio Processing Unit

The Audio Processing Unit primarily receives the signals provide by the Main Control Unit and plays the corresponding sound. The Audio Processing Unit should be capable of playing multiple wave files at the same time because it makes more sense when users press multiple notes together, multiple tones should be generated at the same time instead of one at time. For this, we ordered an Arduino board and the wave shield add-on. However, the libraries provided with the wave shield only supports playing one wave file. Therefore, we needed to modify the libraries so that it can play multiple wave files at the same time. Currently, the Audio Processing Unit is able to play two wave files at the same time. However, when we increase it to three channels, the Audio Processing Unit occasionally crashes when it runs out of memory. We are investigating two

methods to overcome this. The first method is to reduce the buffering size while avoiding affecting the sound quality and the second method is to replace a stronger MCU which has more RAM.

Pitch Detection Algorithm

The pitch detection algorithm is complete in Matlab. The largest obstacle to porting the code to C for an embedded system is the lack of floating point support. We have been unable to find a complete fixed point library and would be required to create our own, which would take a considerable amount of time. We are currently investigating a method of pitch detection that is less robust, but won't require additional math so that we can avoid creating our own math library.

Control/Display Module

The display unit shows which key has been pushed, allows the user to control the various modes and has corresponding status LEDs. An MDF board has been cut into the shape of a grand piano, with LEDs and push buttons mounted on top. The only part remaining is a one rail female connector that can be connected to our MCU module.

Budget

The following table shows what we have spent so far. We received $375 from ESSEF and we have $40.52 left in our account. All the major parts are bought and we still need buy some small components such as plugs and jacks. So the financial status is in good shape.

	Debit	Credit
Funding		$375.00
ATMega32 development board with debugger	$45.00	
Two extra ATMega32 MCUs	$12.00	
Wave shield and Arduino board	$75.00	
SD card	$10.00	
ATMega128 development board	$46.21	
Two extra ATMega128 MCUs	$17.34	
Audio Connector	$2.00	
White MDF board	$11.19	
High pressure water cutting for the board	$20.00	
LEDs/Push Buttons/Female Connectors/Cables	$24.32	
Carpet (black and white)	$41.35	
Foam	$18.90	
Glue and tape	$11.17	
Current Balance		**$40.52**