Wes Petree
Embedded Systems United, Inc.
123 South St. 316
Norman, OK 73019
owpetree@ou.edu
405-308-7412

October 25, 2011

Mobile Systems, LLC
I. Needshelp
345 Oak Road
Pleasanton, CA 94588-2708

Dear Mr. Needshelp,

Embedded Systems United is replying to your recent request for proposal for a new embedded system for your new HC12 device. ESU has been in the embedded systems industry for over 10 years and we use the latest technologies available.

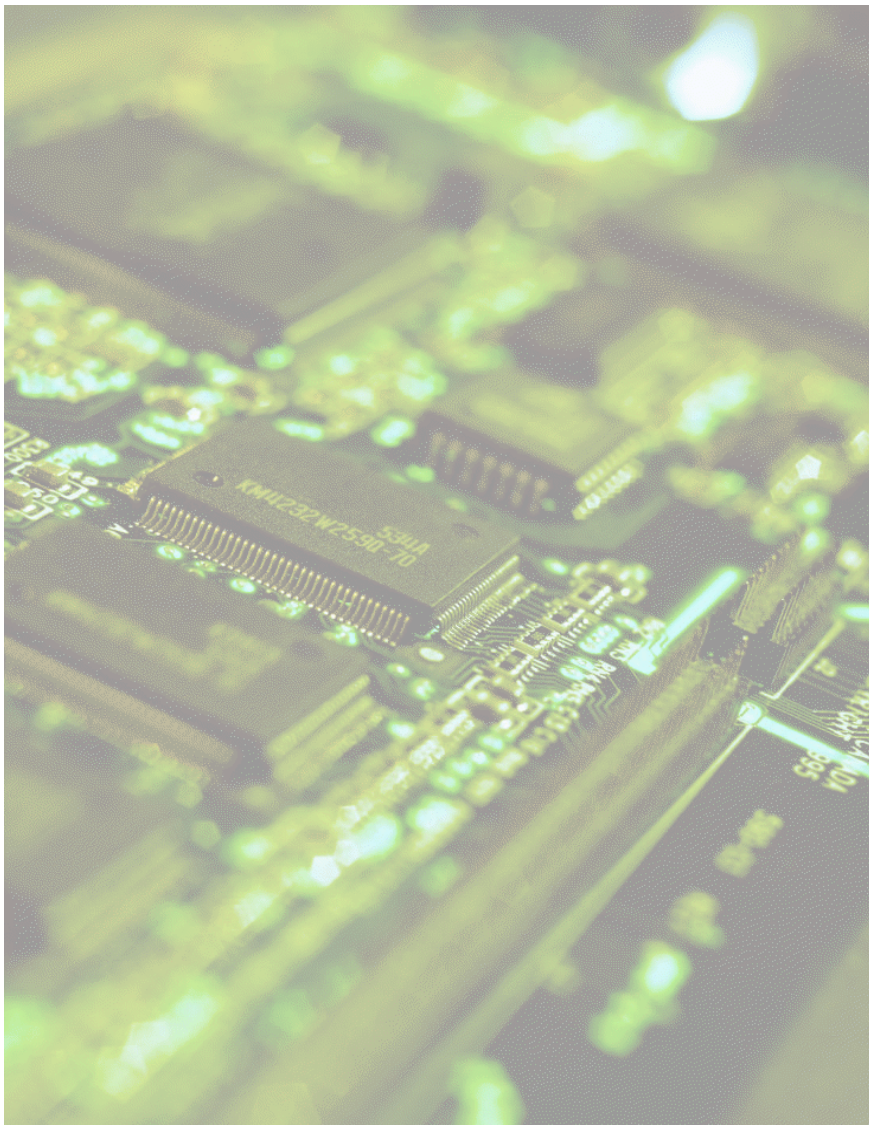
Thank you for considering our company. Please review the following attached proposal. We look forward to being able to sit down with you in the near future to discuss the project.

Sincerely,

Wes Petree

Embedded Systems United

Proposal for the Development of an Embedded System of Mobile System's HC12 based Musical Rhythm Game



Embedded Systems United, Inc.
123 South St. 316
Norman, OK 73019
405-598-2135

Executive Summary

Embedded Systems United is proposing the development of an embedded system in response to Mobile System's request for proposal. ESU has been in business for over ten years and has a combined experience of over 30 years in the industry with extensive knowledge of the HC11 and HC12 processor.

Mobile Systems has requested a small microcontroller memory game system that will output a sequence of notes and lights. The user will have to reproduce this sequence of lights and tones to continue to advance in gameplay. With each successful attempt, a new light/tone will be added to the end of the sequence for user to replicate.

ESU is prepared to implement Mobile System's request to implement an HC12 microprocessor into this musical memory game that utilizes four tones and four LEDs corresponding to those tones. ESU will also implement varying waveforms using Sine, Triangle, and Square wave outputs. A separate mode of non-game play will also be utilized to allow the user to play the different tones and waveforms as a simple instrument.

A graphical LCD display will also be utilized as an oscilloscope. It will display the current waveform that is being played at the moment. When the device is in non-game mode, there will be a switch to allow the user to use the LCD and any two of the tone/waveform combinations to create a Lissajous plot for added value and desirability of the device.

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Proposed Work

Mobile Systems has requested proposals for the development of an HC12 based embedded system used as a musical memory game that utilizes four tones and different colored LEDs corresponding to those tones. ESU is proposing a device that will utilize the HC12, an ESU developed game controller, creates four tones in three waveforms, utilizes a graphical LCD display, and can play multiple tones at the same time. The device will be able to be used in game and non-game modes with four modes of game play in the game mode. When the device is not in game play mode, it can by used as a simple instrument.

Hardware

The hardware design will consist of a game controller with 12 push-button momentary switches and 12 LEDs, EEPROM for storing the program in non-volatile memory, external RAM, an LCD, and a speaker that will play the tones. The hardware will be interfaced with the microcontroller by means of the expanded mode bus, the SPI subsystem, and the SCI subsystem.

- The switches on the game controller will be used to generate the 4 frequencies corresponding to the 4 tones, which will be able to be output as a square wave, triangle wave, or a sine wave. This will give the controller a total of 12 switches – 4 groups of 3 – each group of switches will correspond to one frequency and each switch will output a different waveform. Each switch will have an LED that corresponds to that switch with each grouping having its own designated color – three green, three blue, three red, and three yellow.

- An LCD will be used to output the waveform as on an oscilloscope. When the device is in non-game mode, the LCD can be used to output a Lissajous plot with 2 different tones corresponding to the x and y plots of the Lissajous.

Software

The software design of the system will utilize Freescale's (formerly Motorola) assembly language. The software will allow the user to play in four levels of difficulty, allowing the game to be challenging no matter what the level of ability of the user. Additionally, the timer subsystem will be utilized by means of the output compare interrupts allowing the processor to perform multiple tasks at once.

- The **beginner** level will play in only one waveform – the sine, square, or triangle – and will successively increase from one tone up to 25 tones in random order that the user must remember and play back successfully. Each successful attempt will add another tone and play back slightly faster until reaching 25 tones of memory, at which point the user has one this level.

- The **intermediate** level will play in any waveform but will be generally the same concept as the beginner level. The level of difficulty is significantly greater as the number of usable buttons has increased from 4 to 12.

- The **advanced** level will utilize all waveforms as in the intermediate level but will generate multiple tones at the same time – that is 2 tones will be played at the same time.

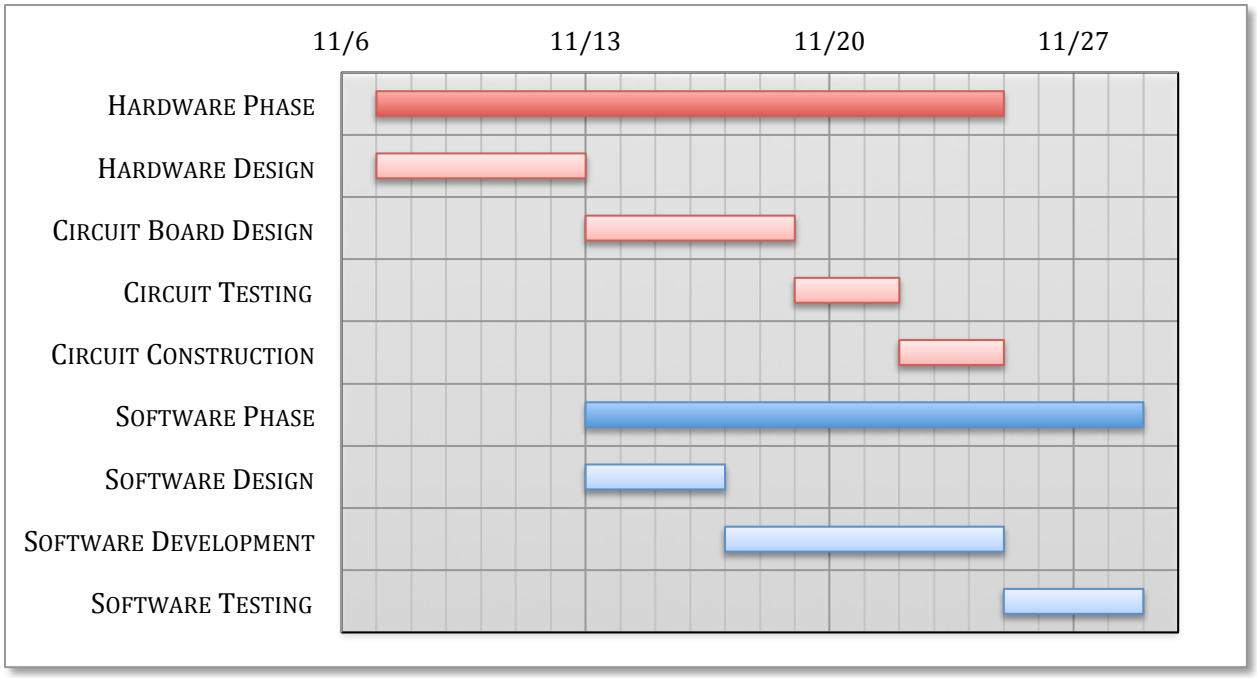
- The **insanity** level will be the same as the advanced level but without the LEDs lighting. A significant amount of attention to the timbre of the sound and the tone will be required to be successful on this level of game play.

Management Plan

Project Deadlines

ESU is projecting the entire project to be completed and delivered by the deadline set by Mobile Systems of December 1, 2011. The project will be completed in two phases – the hardware phase and the software phase. A Gantt chart has been included for a breakdown of the individual project deadlines.

Chart 1: 2-phase project with subsequent deadlines



Budget Summary

A line item budget has been included showing the total budget of $199,194.00.

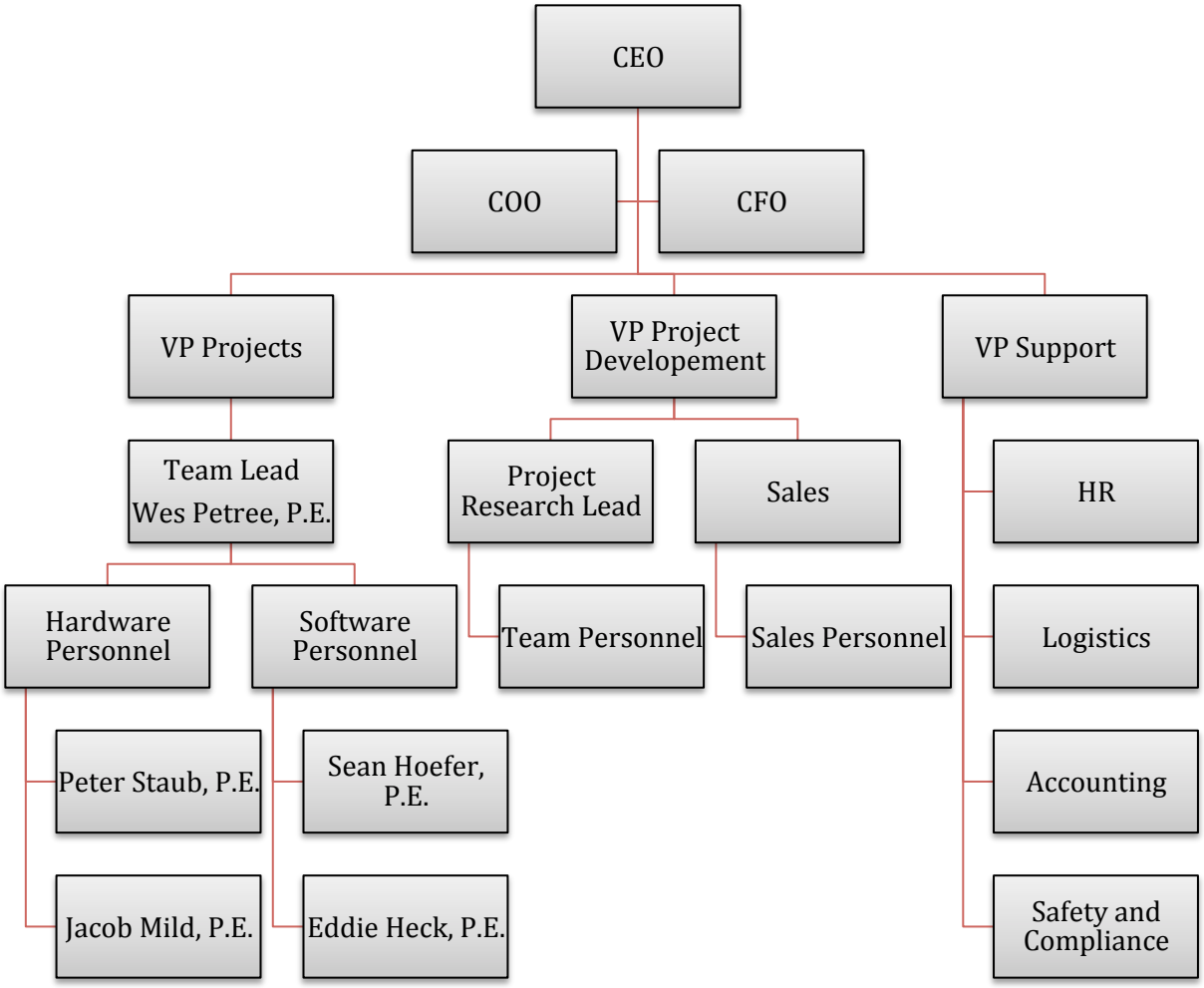
Table 1: Budget Summary

	Budget Summary
Personnel	
Engineering	**$90,232.00**
Other Direct Expenses	
Travel	$1,200.00
Supplies	$2,500.00
Communication	$800.00
Computer Services	$1,500.00
Total:	**$6,000.00**
Overhead	**$74,562.00**
Contingency and Profit	**$34,400.00**
Total:	**$199,194.00**

	Engineering Personnel Detail
Senior Engineer	$22,978.00
Hardware Engineers	$34,186.00
Software Engineers	$33,068.00
Total:	**$90,232.00**

Bidders Capabilities

Chart 2: Embedded Systems United Organizational Chart



ESU is a well-established company that has been in business for over ten years. ESU has been very successful in both the design and implementation of embedded systems for several entities. ESU prides itself in only hiring Professional Engineers and feels that this gives ESU an edge over other engineering firms in the region. Mobile Systems can rest assured that this project will be handled with the utmost professionalism. The entire company, not just the project team, will be on deck, ready to serve Mobile Systems in any way possible.

Team

Wes Petree, Project Lead. Wes will directly supervise the design and construction of the embedded system as requested. He has 22 years experience in the design and construction of embedded systems and has worked for Texas Instruments and Apple before joining ESU. He has been the project manager for ESU for the last seven years and has an impeccable record of meeting budgets and deadlines. He holds a B.S. in Electrical Engineering from the University of Oklahoma and a P.E. license.

Hardware Team

Peter Staub, Electrical Engineer. Peter will be involved in the design and construction of the hardware components. He has 10 years experience and began his career with ESU as an intern. Peter holds a B.S. in Electrical Engineering from the University of Oklahoma and a P.E. license.

Jacob Mild, Electrical Engineer. Jacob is also a member of the hardware team and will be involved in the design and construction of the hardware. He has 5 years experience and has been involved in several of ESU's largest projects. He holds a B.S. in Electrical Engineering from the University of Oklahoma and a P.E. license.

Software Team

Sean Hoefer, Electrical Engineer. Sean will be involved in the design and implementation of the software of the microcontroller. He has 16 years experience in designing both hardware and software of microcontrollers. Before joining ESU, he worked for the USAF and worked on systems for aircraft and missiles including the F-22 raptor and the MQ-1 Predator unmanned aerial vehicle. He holds a B.S. in Electrical Engineering from the University of Oklahoma and a P.E. license.

Eddie Heck, Computer Engineer. Eddie is also a member of the software team. Eddie has 14 years experience as a computer engineer and has worked for Hewlett-Packard for 7 years before joining the ESU team. Eddie holds a B.S. in Computer Engineering from the University of Oklahoma and a P.E. license.

Contact Page

Please contact Wes Petree, Project Manager, in response to this proposal upon selection of Embedded Systems United.

Wes Petree
Embedded Systems United, Inc.
123 South St. 316
Norman, OK 73019
owpetree@ou.edu
405-308-7412

Appendix – attached resumes

Attached are the resumes of the Embedded Systems United engineering project team.

WES PETREE

806 E. Washington, Tecumseh, OK 74873 owpetree@ou.edu ~ 405-308-7412

Objective

Lead Hardware and Software teams of Embedded Systems United in the creative and budget minded engineering solutions of all clients.

Education

University of Oklahoma, Norman, Oklahoma
Bachelor of Science in Electrical Engineering
Date graduated: May 1989

Seminole State College, Seminole, Oklahoma
Associates of Science in Pre-Engineering;
Date graduated: May 1986

Relevant Experience

Texas Instruments Electrical Engineer 1989 – 1995

- On team that designed the embedded systems for the popular TI-83 calculator
- Assisted in developing TI's computer algebra system for the TI-89 & TI-200 systems
- Worked as team leader on several projects

Apple Computers Electrical Engineer 1995 - 2003

- Worked on team that developed the hardware components of the first generation iMac computer system
- Developed many of Apple Computer's troubleshooting techniques

Embedded Systems United Electrical Engineer 2003 – Present

Engineering Manager

- Directly supervised all engineering projects
- Managed resources – financial, human, and equipment

Hardware Engineer

- Designed and supervised construction of all hardware solutions
- Implemented creative solutions to challenging problems

Licensing and Memberships

- Professional Engineering License – 1993
- IEEE – 1988 – Fellow – 2003
- LabVIEW certification – 2006

Peter Garner Staub

1200 S. College Ave. **(432) 553-4843**
Norman, OK 73072 **stau9831@ou.edu**

Qualifications

- Solid work ethic with drive and incentive to accomplish tasks assigned to me
- Reliable worker independently and as a member of a group
- Fast learner who adapts well to new environments
- Personable individual with ability to listen to other's ideas as well as provide my own innovative thoughts

Education

- University of Oklahoma Class of 2002
- Bachelor of Science in Electrical Engineering

Work Experience

Embedded System United

- Intern
  - Hands on experience with building hardware
  - Real word experience in developing Assembly language software
- Junior Engineer
  - Constructed and tested circuit boards
  - Assisted in design of smaller projects with emphasis on hardware
- Hardware Engineer
  - Designed hardware for larger projects
  - Emphasis on budget minded designs with the highest technology available
  - Supervised construction of hardware on all projects

Licensing

Received Professional Engineering License in 2006 in Oklahoma.

1704 Virginia St., Norman, OK 73071•(405)-370-3360•Jacob.C.Mild-1@ou.edu

Jacob C. Mild

Objective

To assist Embedded Systems United in the design and construction of the most cost effective hardware with the highest technologies available.

Experience

2006 - 2010 Embedded Systems United Norman, OK

Junior Engineer

- Draft reports for clients
- Aid in the design of hardware projects
- Construction and testing of circuit boards based on the hardware designs

2010 - Present Embedded Systems United Norman, OK

Hardware Engineer

- Designed hardware projects for major clients
- Assisted in the supervision of junior engineers
- Responsible for quality control of hardware builds

Education and Licensing

University of Oklahoma, Norman, Oklahoma
Bachelors of Science in Environmental Engineering, May 2006

Received Professional Engineering License in 2010 for Oklahoma

Sean Robert Hoefer

11 Nightwind Pl., The Woodlands, TX 77281
281-772-4477

Academics:

University of Oklahoma
Bachelor of Science in Electrical Engineering
Minor in Aerospace Engineering
May 1995

Employment:

United States Air Force 1992 – 1999

- Responsible for maintenance on systems for F-22 raptor and the MQ-1 Predator unmanned aerial vehicle
- Designed new systems when old systems became obsolete

Embedded Systems United 1999 – Present

Software engineer

- Design and develope software solutions for all major projects
- Directly supervise all software engineers and technicians

Awards:

- Air Force ROTC Academic Honors Award (Fall 1994)
  - Academic Honors Cluster (S92, F93, S94, F94, S95)
- Air Force Parachutist Badge Recipient (Spring 1997)
- American Legion Award for Military Excellence (Spring 1997)
- Reserve Officers Association Award (Spring 1998)
- Engineering Deans List (S92, F93, S94, F94, S95)
- Multicultural Engineering Program Outstanding Scholar (S93)

Extracurricular:

- Selected for, and completed Airmanship 490 at United States Air Force Academy (S95)
  - One Cadet per University per year can be selected
- Arnold Air Society
  - Professional service organization comprised of AFROTC cadets
  - Junior Training Officer (F93)
  - Senior Training Officer (F94)
  - Director of Training (F95)
- Undergraduate Research (S95)
  - Part of a six-student team tasked with creating a novel micro-robot for Sandia National Laboratories

Licensing

- Professional Engineering License –1999

- LabVIEW certification – 2004

EDDIE HECK

7601 120th • Noble, OK 73068 • (405) 627-1053 • eheck@ou.edu

Education

University of Oklahoma
Bachelor of Science in Computer Engineering
Date of graduation: May 1997

Oklahoma State University at Oklahoma City
Associate in Science in Police Science
Date of graduation: December 1992

Accreditation

Received Professional Engineering License in 2001 for the States of Oklahoma and Texas.

Skills

- Successful leader, equally effective as member of a team
- Highly organized able to multi-task and accomplish multiple objectives.
- Professional demeanor and attentive to detail
- Effective manager, driven to provide excellent customer service, and able to assess complex situations and formulate solutions
- Budget minded and able to save on hardware resources by creative software implementation

Activities

- American Indian Society for Engineers and Scientist
- Environmental Science Students Association; University of Oklahoma
- Engineers/Sooners without Borders

Work Experience

Embedded Systems United — 2004 – Present

Software Engineer

- Designed software for many ESU projects
- Extensive experience writing in Assembly as well as higher level languages

Hewlett Packard — 1997-2004

Computer Engineer

- Designed hardware for the DS-100x series computers
- Designed HP proprietary software