eyeCU Eye Tracking System

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University of Colorado at Boulder

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Project Description

The aim of our project is to design and implement a low-cost human-computer interface which allows its user to control the computer cursor with eye movements. The wireless eye tracking system will be used to enable people with limited mobility to interact with technology. Currently, there are many eye tracking devices available; however, the price of these commercially available systems is around $30,000. By developing a low-cost eye tracking system, we can make the device a more accessible product for the general public. Unlike common eye tracking methods, this project will be done through clever image processing on a microcontroller as opposed to a desktop computer. This would make our device available to any user. Finally, we plan to make this system a wearable device for portability and ease of use.

The system design employs a head-mounted unit with an infrared video camera to capture the position as well as the motion of the user's gaze. To increase the spectral contrast between the salient features of the eye, a near-infrared light array will be used for illumination. The device processes the images collected by the camera in real-time to generate the corresponding cursor movement which is transmitted wirelessly to the computer.

We have two levels of goals for the tracking of the eye. Level one consists of using 'eye gestures' to control the cursor movement on a computer. In this configuration, when the eye looks left for example, the cursor will move to the left and stop when the eye moves back to the center. In this level, software will be developed to support the eye tracker interface with common computer applications such as clicking, opening browsers, on-screen keyboard, etc. Our high level goal for this project will provide a more intuitive set of commands in which the cursor follows the position of the user's gaze on the computer display. This mode will require additional image processing to determine where the eye is looking and achieve proper cursor motion on the computer display.

Our team for this project consists of five well-rounded and highly motivated individuals, eager to apply their knowledge garnered over the last four years of undergraduate studies. This project will provide us with first-hand experience in the development of sophisticated digital signal processing algorithms as well as embedded systems design. Moreover, our team will enhance our educational experience by engaging in an engineering project from the beginning until the end.

A hardware budget for eyeCU of $1012.37 will be required, which includes ARM Cortex A8 evaluation boards for the development of the image processing algorithms and embedded systems. There will also be cost for extensive testing to ensure successful performance of our device. Therefore, additional funding is necessary to purchase the required hardware in order to develop this eye tracking system. Furthermore, we would like to thank EEF for their continued support of the engineering community, ensuring a rich legacy here at CU.

BUDGET SUMMARY:

Total Project Budget	$	1012.37
EEF Request	$	200.00

Outside funding:

Source	*Confirmed? [Y/N]*	**Total Amount**
Department Contribution	N/A	$ N/A
College Contribution	N/A	$ N/A
UROP	N	$ 800

BUDGET BREAKDOWN:

Equipment and Materials:

Item Name / Description	**Unit Price**	**Quantity**	**Total Amount**
BeagleBone MCU Dev Board	**$89.00**	**2**	**$178.00**
CMOS Camera	**$9.00**	**2**	**$18.00**
NVSRAM 4Mbits (External Memory)	$81.71	2	$163.42
Wireless Transceiver	$22.95	2	$45.90
XBee USB Explorer	$24.95	1	$24.95
PCB Fabrication 4-Layer	$66.00	3	$198.0
PCB Fabrication 2-Layer	$33.00	3	$99.00
Expo Presentation Poster	$50	1	$50.00
Eyeglasses Frame	$5.99	1	$5.99
USB mini smd connector	$1.25	2	$2.50
Ethernet connector	$1.95	1	$1.95
FIFO Buffer	$12.00	2	$24.00
Microcontroller 8051	$4.05	2	$4.05
Package of Zip Ties	$5.99	1	$5.99
Programmable Logic Chip (CPLD)	$1.29	4	$5.16
micro SD Socket for Transflash	$3.95	1	$3.95
micro SD Card Reader	$4.95	1	$4.95
Flash Memory micro SD 4GB	$19.95	2	$39.90
Tantalum Capacitor	$0.95	10	$9.50
Resistor	$0.40	20	$8.00
Voltage Regulator	$1.50	5	$7.50
Battery 3.3V	$2.95	2	$5.90
JTAG Programmer	$55.00	1	$55.00
ARM Cortex A8 MCU	$25.38	2	$50.76
		Total $	1012.37