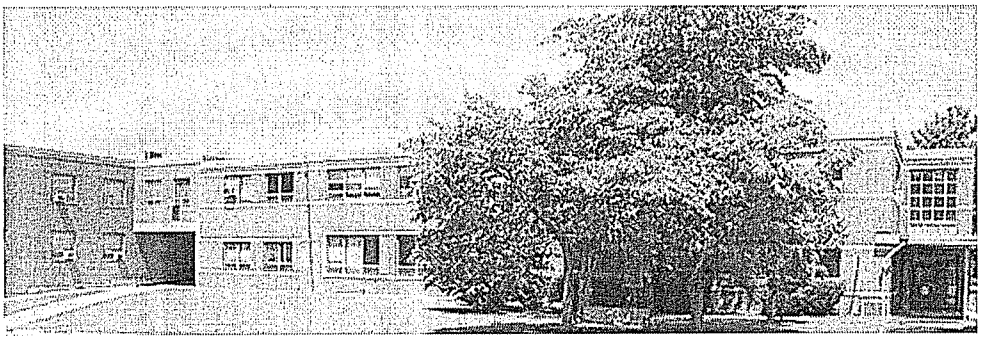
THE
UNIVERSITY
OF RHODE ISLAND
COLLEGE OF
ENGINEERING

THINK BIG WE DO

University of Rhode Island Department of Electrical, Computer, and Biomedical Engineering Senior Capstone Design Projects



Department of Electrical, Computer, and Biomedical Engineering

Senior Electrical, Computer, and Biomedical Engineering Students participate in full year Capstone Design Projects that that give them hands on experience with product development from concept generation to manufacturing, utilizing skills developed from their coursework. Students work in small, multidisciplinary teams with representatives from area companies to solve an engineering design intensive project involving real-world constraints. Participating companies for the 2008-2009 year include Capstone Visual Product Development, General Dynamics Electric Boat, KVH Industries, NABsys Inc., and the University of Rhode Island.

2008-2009 Project Descriptions

Capstone Visual Product Development

CAPSTONE
VISUAL PRODUCT DEVELOPMENT

Video Compression Project

The Capstone Visual Team is designing and developing a system for compressing and decompressing real-time video data at 60Hz and 1920 x 1200 video resolution. The product will offer quality compression with a low error rate and high compression ratio to allow for efficient wireless transmission. The end product will be used in the digital signage market to allow the customer the ability to transmit compressed video data to the LCD panel's video controller using limited bandwidth.

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General Dynamics Electric Boat

GENERAL DYNAMICS Electric Boat

Electric Field Isotropic Sensor

The Electric Boat Capstone Team is developing a low cost electric field isotropic sensor to monitor low power, high frequency emissions from commercial/military devices. Radio frequency waves (RF) can affect electronic devices in many ways. By monitoring the RF waves aboard submarines and other US Navy vessels, military agencies can better comprehend the effects caused by RF waves. In this project, RF signals will be received via antennae, sent through an amplifier to a RF detection chip and finally to a microcontroller for data processing. Depending on the magnitude and frequency of the signal, an alarm will turn on if the signal is above a specified threshold.

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DLM Antennas Implemented as Filters

Students in this project were given the opportunity to work with in-house experimental antenna fabrication techniques. The project began with training on characterizing, analyzing, and fabricating antennas. After the training stage, students built and fabricated their own antennas. Midway through the year, the developed antennas were found to be extremely unique, in that they defied how most antennas work. The design group is now pursuing patents for their design and will be publishing articles in research journals.

KVH Industries

KVH INDUSTRIES

Orientation Data Logger

The KVH team is developing a data logging system to be used in autonomously collecting and recording information describing the orientation of a boat or ship. The data logger will be mounted externally on a boat to record and track the motion of the vessel for a period of three hours by measuring the vessel's longitude and latitude and six degrees of freedom (roll, pitch, yaw, heave, surge, and sway) at a rate of 100Hz. This improved data logger design is more efficient in collecting data over a long period of time, whereas previous data collection had to be done manually. Additionally, the data logging system can also be used for data analysis through Microsoft Excel or MATLAB.

Satellite Control Module

The KVH team is designing a satellite control module to be used in boats and ships to decrease the amount of hardware needed to view satellite television. The control module will be placed in between the receiver box and antenna on the boat, to track signals sent out by the receiver and send signals to the antenna. When a channel is changed by the customer, and that new channel requires a different satellite than that of the previous channel, the receiver will send a signal to the control module. This signal will need to be deciphered to see which satellite is needed. The control module will then send out a signal to tell the antenna which satellite to point to. In the past KVH used multiple antennas on the boat that were each set to a certain satellite, but this was costly and required a lot of hardware. With this new design, only one antenna will be needed, which will decrease customer cost, and hardware needed.

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NABsys Inc.

Patch Clamp Amplifier

NABsys has asked URI to assist in their development of the Hybridization-Assisted Nanopore Sequencing (HANS) platform. The project combines physics, bio-chemistry, computer science, and electrical engineering to sequence DNA in a novel way that is less expensive and faster than any other available technology. HANS brings together nanopore sequencing and sequencing-by-hybridization to map out an individual's entire genome; Only one complete genome exists today. The process begins by developing single stranded 100kb DNA fragments and attaching 6-mer probes to them. This combination is then driven through a nanopore and current-versus-time tracking then takes place. From base pairing rules the sequence of certain portions of the genomic fragments are known. These known pairs allow for a comparative basis, evaluating the time it takes to move a fragment through the nanopore versus the current supplied. This will hopefully lead to a faster and inexpensive gene sequencing tool. Currently NABsys is using a $15,000 100mV high current amplifier that is too large and expensive to efficiently pass current through the nanopore. NABsys has asked the URI team to develop an improved amplifier for less cost to further their plan of a cheaper, smaller, and more available gene sequencing technique.

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Traffic Data Logging System

In order to investigate the factors affecting a driver's performance such as road hazards, a traffic data logging system is under development at URI. The system monitors both a driver's eye movement and the position of the vehicle itself to identify unsafe behavior. The eye tracking system consists of a high performance camera mounted on the driver's forehead to record the scene from their perspective. A second camera is aimed at a reflector to track the driver's left eye pupil movement. The two video streams are processed together to produce a video from the subjects perspective with an overlaid cursor showing exactly what is being tracked by the driver. In order to determine the vehicle's real-time position, two sensors are currently employed: A GPS receiver and an accelerometer. The system will ultimately be used to alert a driver of any potentially hazardous behaviors, weather patterns, or traffic conditions. Once development is completed, the system will be used to collect valuable data that will improve the safety of driving for everyone.