A Research Experience for Teachers at Notre Dame
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MATLAB

“MATLAB® is a sophisticated computing language and advance computational program.

MATLAB is a product of MathWorks.  http://www.mathworks.com/
The first year engineering students at the University of Notre Dame are required to take an eight-week course: *Into to Engineering Systems 1 – via MATLAB* (EG10111)

- Students learn the fundamentals of computer programming using MATLAB
Reasoning for Research

Into to Engineering Systems 1 can be a very challenging course for some first year freshmen.

The premise of the WiiMote research is to continue to develop a class structure that would encourage self-efficacy among the students in Into to Engineering Systems.
The motivation tool the research would focus on is the Nintendo Wii Remote Controller.

As of 2006 50 million Wii Consoles have been sold. Each Console comes with a Nintendo Wii Remote Controller that is equipped with Bluetooth capabilities. The Wii Controller also has a infrared camera that will respond to infrared light.
The popularity, sophistication and affordable price made the Wii Controller a feasible tool for students to work with.

In the Summer of 2008, two students in the Research Experience for Undergraduates (REU), Jordan Brindza, Jessica Szweda created WiiLab. WiiLab contains all the basic programs needed to create games in MATLAB using the Wii Controller.
In the Summer of 2009, two REU students Mark Overholt and Simon Zhang continued developing games that require the use of the Wii Controller. Mark and Simon created WiiDorf.

WiiDoRF is 100% open source, highly modular, Java written code, statistical data mining with its back end MySQL database. Could be used by educators and psychologists to study and keep track of a user's learning (Mark Overholt, Simon Zhang).

In addition to Mark and Simon one high school teacher was chosen Juanita Gerard to assist with suggestion on how games written for the Wii Controller could be used in the classroom.
Experience Using MATLAB

- The RET program provided me with my first opportunity to learn MATLAB. The textbook assigned, *A Concise Introduction to MATLAB*, is also used in the *Into to Engineering Systems 1 – via MATLAB* class.

- I spent the first weeks going through the assignment given in the *Into to Engineering Systems 1 – via MATLAB* class.

- All assignments are placed online for the students.
% add the path containing simple graphics functions
addpath C:\Program Files\WiiLab\WiiLab_Matlab\EG111-H
% add the path containing the Wiimote functions
addpath C:\Program Files\WiiLAB\WiiLAB_Matlab\WiimoteFunctions

% Constants
numTargets = 25;  % # >= 1 indicating the total number of target squares
velDamping = 1;  % # <= 1 indicating how the accel values are scaled to vel
numRows = 5;
numCols = 5;
blockW = 3;
blockH = .5;
ballRad = .5;

% Create an instance of the wiimote and connect it
initializeWiimote();

blocks = zeros(1,numTargets);
hit = zeros(1, numTargets);
if(isWiimoteConnected() > 0)
    initializeWindow(0);

%Generate Blocks
for i = 1:numRows
    for j = 1:numCols
        color = mod(i+j, 5);
        switch color
            case 1
                dColor = 'green';
            case 2
                dColor = 'red';
            case 3
                dColor = 'yellow';
            case 4

Dr. Striegel allowed me access to his lecture notes and the MATLAB codes needed for the assignments. The assignment codes proved to be a necessity in order for me to go over the assignments.
Learning MATLAB was difficult

Dr. Striegel along with Mark Overholt and Simon Zhang would assist me in writing code in MATLAB

The textbook assumes the reader has a great deal of programming knowledge.

The program MATLAB has a vast amount of online help, but you need to know more than basic programming to follow the help guides.
Objective of program Circle–Draw–Project was to create a filled circle on a coordinate grid.

- Move the Circle around the grid using the WiiMote Controller
- As the Circle moved the x and y coordinates of the center of the circle would display at the top of the page.
I used the WiiLab files to help build the program. The game must be started using the WiiMote.

My program would not work. Dr. Striegel looked at my code and found that a file name was not a correct match to the function being called.

After I changed the file name, the window appeared with the x and y lines, the filled circle and the text instructions.
Mark provided me with many suggestions on what files I needed to have in my folder and how to set-up my code.

\[
\begin{align*}
    x &= 600 \\
    y &= 550 \\
    \text{Use the up/down arrows to move the ball vertically.} \\
    \text{Use the left/right arrows to move the circle horizontally.} \\
    \text{Press B to Begin} \\
    \text{Press the Home button to exit the game.} \\
    \text{Equation of a Circle } (x-h)^2 + (y-k)^2 = r
\end{align*}
\]
Circle–Draw–Project

The program runs until one of the arrows of the pad are called. In the second drawing two text lines are hidden after pressing the B–button on the Wii Controller.

\[
\begin{align*}
\text{Use the up/down arrows to move the ball vertically.} & \quad x = 600 \\
\text{Use the left/right arrows to move the circle horizontally.} & \quad y = 550 \\
\text{Press B to Begin} \\
\text{Press the Home button to exit the game.} \\
\text{Equation of a Circle} (x-h)^2 + (y-k)^2 = r
\end{align*}
\]
As I researched the Wii Controller on the Internet I learned that there are many code developers who are designing games or other programs for the Wii Controller.

The most prominent is Johnny Chung Lee at http://johnnylee.net/projects/wii/

Also Brian Peek at http://www.brianpeek.com/blog/pages/net-based-wiimote-applications.aspx
Mark Overholt also taught me how to build an infrared pen and an infrared Sensor Bar.

With a LCD projector, infrared pen and software created by Johnny Lee you can make any whiteboard into an interactive electronic writing board.
References

- Mark Overholt, Simon Zhang: *WiiDoRF, Summer 2009*, http://netscale.cse.nd.edu/twiki/bin/view/Ed/WiiDoRF
- MATLAB: http://www.mathworks.com