

Infrared Based Interacting White Board

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Abstract—Despite a smart board’s ability to teach and demonstrate, interactive white boards are expensive by ranging up to prices in thousands of US dollars. Due to touching screens costing at high values, an alternative design could be created in order to reduce the price. The idea for the project is to use infrared based technology to transform a white board and projector into a distance based interacting white board. The project combines Arduino coding and an Infrared coordinates tracking camera in order to simulate mouse movement in conjunction with an Infrared emitting bar as a reference point. The handheld portion is simple to use and allows a wide degree of control from a distance in respects to the white board.

I. INTRODUCTION

Electronic Interactive White Boards are notorious for their prices ranging up to thousands of dollars with a variety of quality. This makes the decision of buying an interactive white board a tough decision. However, a cheaper alternative was created in late 2007 by a man named Johnny Chung Lee [1]. The Nintendo Wii Remote, fabricated by Nintendo, was created in 2006 to be used in point and motion-based games incorporating an infrared sensing bar [2]. Despite Nintendo’s insisted use of the phrase “Sensing bar”, this was nothing more than a ruse, as the actual sensing application lies within the tip of the Wii Remote [3]. Using the “Sensing bar” as a reference point, which has 5 Infrared LEDs on each side, the Infrared camera on the tip of the Wii Remote uses these LEDs as coordinates. Pointing the Wii Remote up gives the camera the impression that the LEDs are moving down. By inverting those coordinates, the Wii Remote signals the Wii Console to move the digital arrow in respects to the movement of the Wii Remote. The Wii Remote’s Infrared Camera is the key to Johnny’s design to create an interactive white board by using an IR camera and movable IR LEDs.

With the use of a different Infrared tracking camera and IR LEDs, the device needs to be designed to be easy to install and use on any white board with projector that is connected to a computer.

II. MATERIALS AND CODING

Which ever devices are used, the results need to fit within the palm of a human hand. The main component to create the baton is the IR Tracking Camera. It requires a 3.3V input and connects to the SDA and SDC ports of the M0 Feather Weight. The M0 was chosen due to its small and light size. Since the device should be wireless to gain use of the IR

Tracking camera’s working distance of 3.3 meters, a blue tooth module was added to the design. A small battery along with a charger was incorporated within the designed for a reduced size and the ability to charge the device. Several push buttons are on the top shells to be used as left, right and middle mouse clicks. A power button is also on the top shell to turn the device on and off.

The IR LED bar uses 100mA and 940nm infrared LEDs. Each side has 4 LEDs with a separation distance of 200mms. PCB board is powered by a cable and outlet combo to keep the LEDs powered. Each set of LEDs is powered by a 30-ohm resistor. Due to the limited amount of time, a covering shell was never created.

The feather weight, being an Arduino product, is programmed with Arduino based code. The code the device uses is from SAMCO [4]. The code uses various libraries in order to use the IR tracking camera and Absmouse for the coordinates to be translated into mouse movement. Due to the code being essential for the device, a link to the perfected edited code will be given via a link within the operator’s manual.



Fig.1. IR Tracking Camera

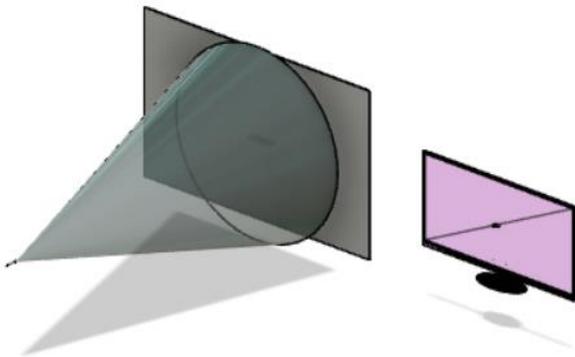
III. PROTOTYPE DESIGN

As stated previously, the design must fit into the palm of the user’s hand. Right or left, it does not matter. The baton, which is now called the IR Remote, needed all the components to be arranged to retain a cylinder and prism hybrid shape. The battery and charger are in the far back of the shell. This allows an easy connection for the battery to the charger while also leaving the micro USB charger (USB type B) exposed. The very front of the design must be the IR tracking camera for the sake of pointing at the IR emitting

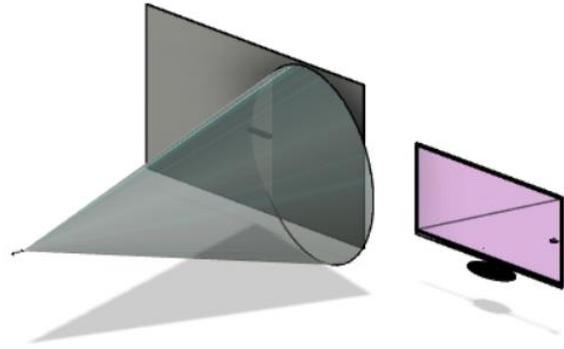
bar. A model of a human hand and other handheld remote devices were used in the creation of the size and length of the prototype in case for adjustments. Due to the odd shape of the Bluetooth module, minor adjustments had to be made in order the M0 feather weight can be placed directly on top of it. The M0 needs to be directly connected to the Bluetooth module through its TX and RX ports while also supplying the device with power from the 3.3V port. The IR tracking camera is connected to the M0's SDA and SDC ports. The M0 is also connected to the charger unit directly instead of USB type A and USB type B connection in order to conserve space. 4 buttons with the 4th one being a switch button is used for the right, middle and left mouse clicks with the final button being the on and off switch. Fig 3 being the prototype.

IV. DEMONSTRATION

Figure 2 demonstrates how the IR Remote operates. By turning on the power button, the IR Remote sends out a Bluetooth signal. The computer that can pair up with that device will not be able to use the IR Remote until a code is downloaded from the operator's manual. The Projector that is connected to the computer displays the monitor and placed in the center of the projection is the IR emitting bar. The bar is held up by either sticky tack or tape. If the board has a metal sheet underneath, magnets should also be possible. Regardless, the bar must be set in the center of the projection. After the code is downloaded and ran, the IR Baton now acts like a wireless mouse. By pointing at the projection, moving left, right, up or down causes the mouse on the computer monitor to move. Since the projector is projecting the screen on the computer monitor, this simulates movement. The best operating distance for the user is about 3.3 to 2.7 meters. The user does not have to be directly in front of the board and can stand from the sides on a 23-degree angle from the edges of the board. Clicking the left button, preferable with the uses thumb or other index finger, simulates a left mouse click. The right button simulates a right mouse click. The middle button cannot act as a scrolling wheel, but if held down, the user can point up and down to move pages vertically.



2a) Pointing to center



2b) Pointing to right

Fig.2. Demonstration of the IR Remote

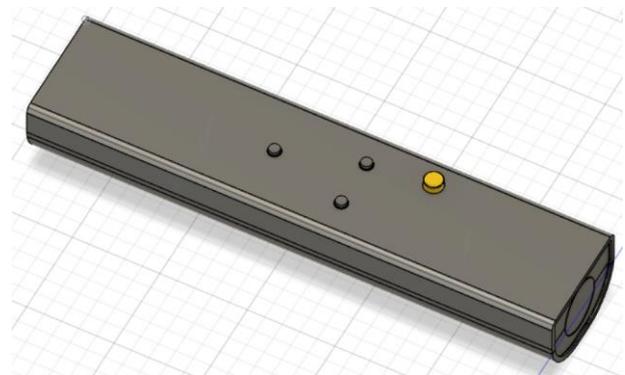


Fig.3. IR Remote

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