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VIRTUAL TOUCH SCREEN USING PROJECTOR AND CAMERA

M.Koushika, M.Shenbagapriya, T.Sinthiya

Guided by

Dr.J.Augustin Jacob & Mr.R.S.Venkatesan, Assistant professor of ECE, Kamaraj College of Engineering And Technology.

Abstract—This project proposes a large interactive display with virtual touch buttons on a pale-colored flat wall. The system consists of a front projector and a camera. A button touch is detected based on the shadow cast by the user's hand. The touch is detected by the area of shadow that covers the button region. Therefore, no time consuming operations, such as morphing or shape analysis, are required. The reference image for the background is continuously adjusted to match the ambient light. When tested, our scheme proved robust to differences in illumination. The response time for touch detection was about 120 ms.

Keywords—Projector-camera Systems, Projector-based Display, Touch Detection, Virtual Touch Screen.

I. INTRODUCTION

As consumer-grade digital projectors and cameras have become less expensive, many interactive projector-camera systems have been proposed. In particular, since ordinary flat walls can be used as the screen, large interactive displays can be used for digital signage and information boards in public spaces without the need for expensive touch panels. There are two types of user interaction under a projector-lighted environment. One is gesture based (primarily hand gestures), and the other is touchscreen based. For a gesture interface, users must learn the gestures corresponding to defined functions and may need training. On the other hand, touching the screen is intuitive and increasingly popular due to the recent spread of touch-based devices such as smartphones.

The aim of this paper is to make large, economical interactive displays; therefore, we use a projector and a nearby camera. A hand touch on the screen is detected by the area of the shadow cast by the user's hand. The key idea is that the shadow color does not depend on the projected color. The issue is when and how to alter the button color to capitalize on this idea without sacrificing usability.

This virtual touchscreen system is designed to function in a space where ambient light conditions may change. VIRTOS continually monitors the touch area, and when a shadow covers and stops on the button, the color of the projected touch button is altered. If the shadow area is

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not changed, then the system recognizes this as a touch. The reference image for each button, is continuously updated to account for changes in ambient light. We tested the accuracy and response time of our virtual touch button. [5] discussed about Nanorobots Control Activation For Stenosed Coronary Occlusion, this paper presents the study of nanorobots control activation for stenosed coronary occlusion, with the practical use of chemical and thermal gradients for biomedical problems.

II. METHODOLOGY

A. *Existing system*

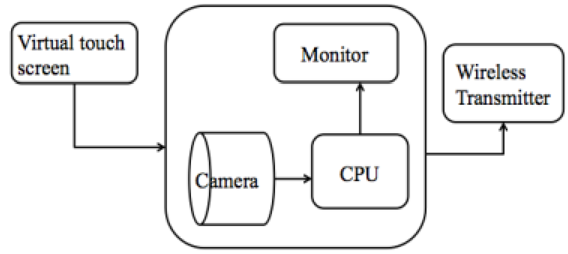
This system uses complex technology and image processing for detecting the images captured by the camera.

B. *Proposed system*

It has Virtual reality sensing and control. We propose a large interactive display with virtual touch buttons on a pale-colored flat wall. Time consuming operation is very less when compared to the existing system. It is a easy-to-install system consists of a front projector and camera.

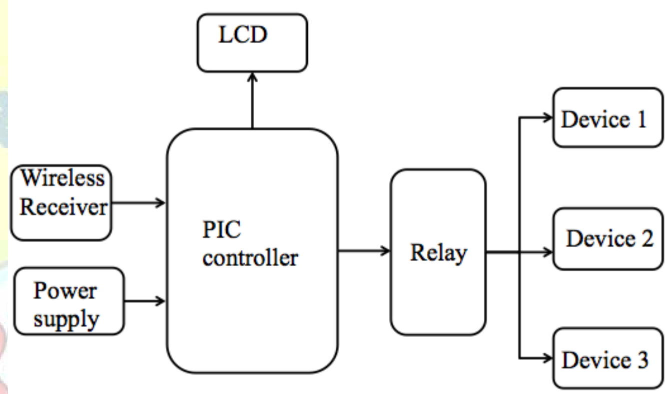
III. BLOCK DIAGRAM

A. *Transmitter side*



Transmitter side

B. *Receiver side*



Receiver side

C. *Experimental Description*

A pale colored flat wall is used as a touch screen. A projector and a camera are connected together as a single module. The projector is programmed with .net for the display of six buttons (3 buttons for ON state and other 3 for OFF state). The camera connected captures the reference images and updates the zigbee. When a shadow is detected it transmits the data continuously to the receiver until it detects next operation. It takes some milliseconds to complete the previous operation.

A zigbee transmitter is used to transmit the numerical data (as hex values) obtained

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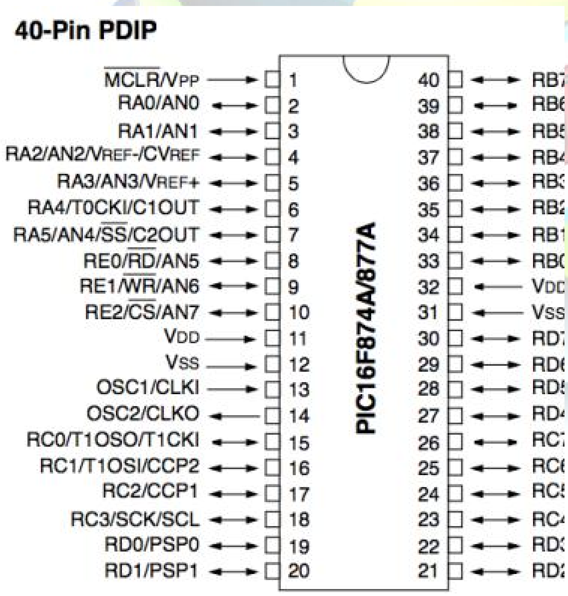
from the projector. Each and every button is configured with unique hex values.

Here we are using PIC16f877A controller. The controller receives the serial data from the zigbee receiver and operates according to the data received. The zigbee receiver is interfaced with controller through a RS232 cable.

The LCD is interfaced in the receiver side displays the status of the loads connected to the controller. Here we are using three different loads: a buzzer and two motors.

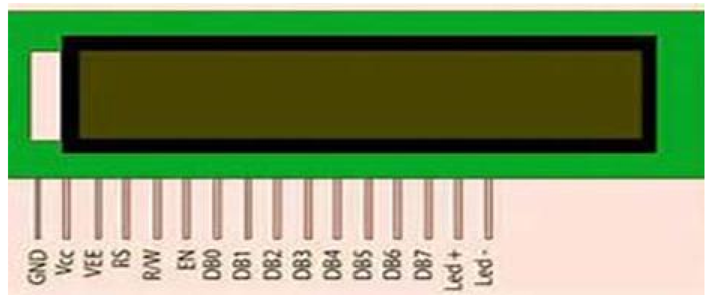
D. *PIC Controller*

PIC 16f877A is 8 bit micro controller. It has various modules such as PWM,3-timers(Timer 0 ,Timer 1,Timer2) , 2-CCP modules, UART, ADC, Registers, SFR, EEPROM, Oscillator(0-20MHz), I/O ports - PORT A to PORT F. In that, PORT B, PORT C, PORT D have 8-pins. PORT A has 6-pins. PORT E has 3-pins. We are using four modules UART, Timer, CCP, PORT A to PORT E.



E. *LCD*

Here we are using 16x2 LCD. There are two inputs for LCD. They are command and Data lines.



If RS= 0,then input is a Command, then enable and disable the E pin.If RS= 1,then input is a Data, againenable and disable the E pin. The pins from DB0 to DB7 are data lines which are used to display. For write operation, R/W =0;For read operation R/W=1.To Load the registers, we have to refer the data sheet of LCD. Here we are using only for write operation, so R/W pin is grounded.

F. *ZigBee*

ZigBee operates in industrial, scientific and medical (ISM) radio bands. Data rates vary from 20 kbit/s (**868 MHz** band) to 250 kbit/s (**2.4 GHz** band) best suited for intermittent data transmissions from a sensor or input device. It is an IEEE 802.15.4-based specification for a suite of high-levelcommunication protocols used to create personal area networks with small, low-power digital radios. It is a short-range wireless communication protocol. Its low power consumption limits transmission distances to 10 –100 meters line-of-sight, depending on power output and environmental characteristics. The data transferred have a maximum size of 128 bytes. ZigBee devices can transmit data over long distances by passing data through a meshnetwork of intermediate devices to reach more distant ones. It is typically used in low data rate applications that require long battery life and secure networking.

Zigbee is uses Simple Cable Replacement System and transmits upto 1024 I/O values. It shows local indication

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of Input Values.ZigBeeconnects automatically and transmit only a single variable to a receiver unit.

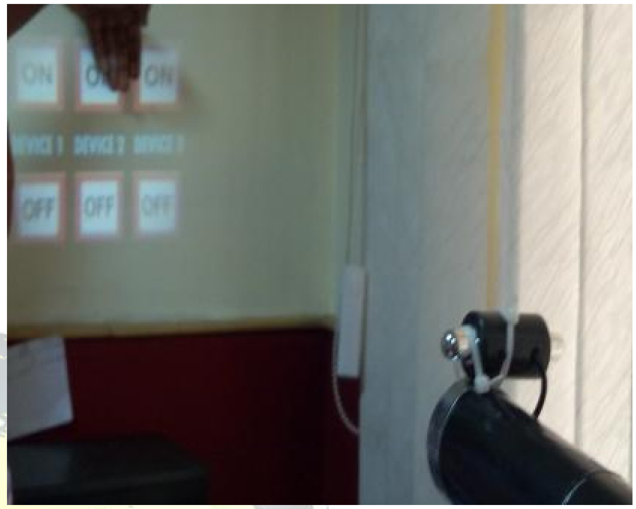
IV. SOFTWARE USED

Here we are using dotnet, MpxLab IDE and proteus. Dotnet coding is used in projector. Dot net is a general purpose software development platform similar to java. As its core is a virtual machine that turns intermediate language(IL) into machine code. High level language compliers for C#, VB.net and C++ are provided to turn source code into IL. Windows 95 does not supports dotnet. MpxLab IDE and proteus are used for simulating the system.

MpxLab IDE is used to write the code for implementing the system. Proteus is used to simulate the code written.

V. RESULTS AND DISCUSSION

A. *Buttons*



B. *Transmitter side*

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C.Receiver side

The advantages of our system are low time consumption, easy-to-install, no need of image processing to detect the images. This system can be implemented in real time applications such as in Slide presentations, Microsoft Kinect and also in public halls.

CONCLUSION

This paper works robustly for gradual illumination change around the system because the criterion for detecting shadow pixels in the camera image is whether a change occurred after altering the button color. In addition, no optical calibration or coordination between the projector and the camera is required. We evaluated the accuracy of our touch button and its response time. These evaluations show that VIRTOS is suitable for practical applications.

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