VIRTUAL REALITY IMPLEMENTATION IN HOME AUTOMATION

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Abstract— Home Automation is becoming a crucial part in fast growing economies. Recently it's technologies are changing rapidly and different automating strategies are being implemented. The conceptual understanding for automation is changed, and new ways of producing super sensor system are showing up. So basically home automation is "One way to manage everything, not lots of ways to manage lots of things". In normal Electrical circuit combination in all the Indian houses people tend to do many mistakes while using it. The prime mistakes are not switching off the electrical gadgets when not required or when not in use. People tend to either forget when moving out or ignore. This results in wastage of energy without using it. To eradicate all these drawback it's better to adopt Automation techniques. So here we are aiming to provide a fully automated system which can ensure safety by switching ON and OFF of the electrical devices based on user's action. The background subtraction methodology is used in extracting the foreground region. The reference image of the background is continuously adjusted to match the foreground image. Thus the touch detection takes place. When we tested our system it proved to be robust to differences in illumination. It resulted in controlling the devices with a minimum response time of 160ms.

Index Terms— Virtual Reality sensing system, Zigbee, Touch Detection,Camera

1 INTRODUCTION

As the world is fascinated with the Virtual Reality and its applications many VR applications has been proposed recently. In particular advancement in automation has been the trend in recent times and automation has been the technological for many problems and it also helps in quick efficient precise functioning of the particular system. Virtual Reality reduces human effort. It usually uses monitor, projector screen and a VR headset for interaction. Here we propose a system which automates all the electronic component of a particular place based on the bandwidth of the Zigbee.

All the electronic component such as Air Conditioners, Fans, Bulbs etc can be controlled from any place and any time. This has been the primary benefit of this system. Based on the research done, the previous automation system didn't stressed about the distance from which the electronic components can be activated and deactivated. The earlier system uses advance and complex components where both costs and complexity in connection and repairs are more. Most of the previous systems works only on one type of electronic instruments (like particular system controls only bulbs and some only fans etc).Moreover all the components used in this system are easily available in market, therefore one can easily change the components in case of any repairs.

As we use 8051 Microcontroller, small cameras and projectors the expenditure for the system can be reduced rapidly. This system also helps in reducing power consumption as it can be operated from any place and any time. This system also increases human comfort. Ease of use has been the motto of our system which just requires a touch.

In the previous work, [1]the system did not work when there is a fluctuations in the power, the desired result was not obtained when tested. When depth sensor is used for recognizing the touch, it becomes expensive. In the proposed system, it produces the desired result even when there is a power fluctuation. Camera used in the proposed system captures the touch made, using background subtraction methodology[2] and the devices are powered up. The configuration of the system becomes simple. Hence we go for Home Automation Using Virtual Reality.

2 HOME AUTOMATION USING VIRTUAL REALITY

The methodology used in this system is the Background subtraction methodology or foreground subtraction methodology[3]. It is used in the fields of image processing wherein foreground image is extracted for further processing. The following are the various categories of reference images that can be subtracted from the camera input images:

1) Real Background: By memorizing the image of the screen wherever a virtual button image is projected.

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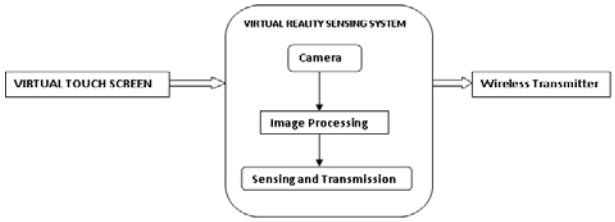
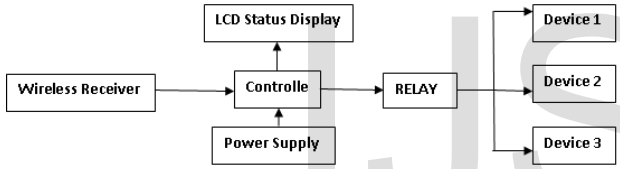
2) Dynamic background estimation: Estimating pixel values of background at each pixel based on many input frames.
3) Background Synthesization: by predicting the image of each pixel from the mapping relation derived by comparing the projected image and the reference samples taken by the camera during system initialization[4][5][6].

2.1 VIRTUAL REALITY USING HOME AUTOMATION FRAMEWORK

Transmitter Module



Receiver Module



WORKING PRINCIPLE

Virtual touch screen: There are different techniques available to detect a touch of hand or a finger on the screen. We used virtual touch buttons to indicate ON/OFF states, because touch buttons are familiar and fundamental widgets for touch interfaces. The virtual touch screen may be a plane wall or any other flat surface. This screen gives a feel of touching the device control unit for controlling the devices. When the screen is touched the devices are controlled based upon the touch(either ON or OFF).

Virtual Reality sensing system: The virtual reality sensing system helps in sensing the touch made on the surface. The touch made is identified using the camera that is fixed with the virtual reality sensing device. The touch is identified using the background subtraction methodology, through which the shadow of the hand alone is taken for controlling the devices. Software is used to check, the area of our touch, it has a display unit, which helps in identifying whether the touch made is appropriate or not[7][8]. There are various stages in the touch detection process:

Normal: The button is not touched currently and nothing is covering the button.

Waiting: The palm is covering the button, the system starts processing once the hand is taken back.

Checking: The system senses the button status whether the hand is touching the button or not.

Wireless Transmitter: It uses Zigbee 1.2 for home automation. Zigbee helps in getting the signal from the sensing system, processes it and sends to the receiver.

Wireless Receiver: This circuit helps in receiving the signals from the transmitting unit through Zigbee.

8051 Microcontroller: It provides a great advantage that a program is stored in ROM. Since the program written into ROM is fixed, it cannot be altered or changed; as a result the operation of the system remains constant (unchanged) regardless of the instructions given to it. Hence, a microcontroller can be thought of a device containing on-chip program memory. Microcontroller is hardcoded with the inputs it has to take from the sensing unit. Example: when the touch is made to switch on the device the input taken is ”A”, for switching off the input is taken as ”B”. The microcontroller is coded in such a way that the devices can be switched on and switched off without any complications.

LCD display: Shows the status of every device.

Relay Unit: Acts as a switch, which helps in identifying the touch made and switch on or switch off the device as per the input received from the microcontroller.

3 RESULTS AND ANALYSIS

The virtual sensing unit along with the camera helps in detecting the touch made by the user, depending upon the touch the data is sent to the micro controller. As the micro controller is already programmed the hardcoded data is sent via transmitting Zigbee to the receiving Zigbee[10]. The device is switched on or switched off based upon the data received by the relay unit.

We tested the accuracy and response time for our virtual reality system. The response time for the proposed system is observed to be 160ms.

Issues with Implementation: Though the implementation seems to be easy, there are a few limitations with respect to positions. The position of the virtual reality unit should be able to project the contents clearly on the screen. The angle of the camera must be fixed or unaltered so as to capture the touch clearly. So it is necessary to consider the position of camera and the virtual reality unit.

Test Cases: 1) The angle of the camera must be fixed. If the angle changes the touch cannot be detected by the system.2) The shadow of the hand should not fall on other devices shown on the screen, the system gets confused and the desired result cannot be obtained.

4 CONCLUSION

We proposed a Home Automation Using Virtual Reality which consists of Virtual reality sensing unit, camera, Zigbee Microcontroller and relays. The touch made is identified using virtual reality sensing system and the devices are powered on or off based on the user's action.

As Automation is becoming the trend nowadays, automating the home appliances using remote controls has limitations with respect to distance. Home automation using virtual reality helps in accessing the devices from anywhere around if the frequency of Zigbee is increased.

We evaluated the accuracy and response of our system, these evaluation shows that virtual reality is suitable for practical applications.

We still need to improve some aspects of Home automation using virtual reality sensing system for example, further reducing the complications of unnecessary shadow falling on to other buttons and powering of the devices. We are also planning to develop more applications and them in practical environments.

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