Design and Development of Hardware System for Virtual Keyboard Projection on Planar Surfaces

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This work provides a new smart projection frame (IPS), which authorize uncovered finger touch group on normal planar surfaces, with one projector and one camera. The test of detection finger touch identification is recovering the touching facts just from the 2-D image catch by the camera. In this system, the graphical user interface (GUI) catch is expected at initial glance and is distorted by the finger when press it, and there is a large positive relation between the button's twisted and the finger's position to the surface. Therefore, this project suggests a new, fast, and strong calculation, which exploits the catch distortion to determine the touch activity. The present keyboard used keys structured keyboard for typing in light of the computer. These keyboards are chipping away at the mechanical push level. In anyway, for the small tools like cell phones and tablets it is hard to carry large console with them. The touchscreen basis keyboard to reach in such tools is very poor designed to formation in light of the fact that the measure of individual's finger is huge and the extent of the keys on the touch screen is little. So, writing chip away at the small tools is not useful and on computer our fingers get torment in the wake of doing long time typing work as a result of mechanical vibration of the keys. This work is about a virtual keyboard on any planer surfaces for convenient touch action. The Region of interest extraction is through a Homography mapping which is used to reduce the computational complexity of the work.

Keywords: GUI; Key Board; Touch Screen;Planar Surfaces

Introduction

This project is about mobile device users suffering from small keyboard use while they type long articles on computers. To reduce the pain in the fingers and to involve technologies development this small keyboard is replaced to provide easy of writing with virtual keyboard. In 1992 the first virtual keyboard was introduced by International Business Machines Corporation (IBM) and therefore in 2002 this virtual keyboard was developed by company Canasta. The portable devices (mobile phones, pads) pose a significant part in the daily lives of individuals with the power and computational capacity. This device is easy to carry because of its small size. However, the screen space in these devices is limited due to its small size. This reduces of their ease of use, functionality and comfort. Pico projectors can be used to increase the size of the limited screen of mobile devices. With the development of projection technology, the projection will be an important spot in the mobile phone and the user find easy and great fun in the presentation of digital contents on the surfaces. At the same time, the interactions (such as touch and gesture) on the projected display think to be attractive. To reach the touch interaction, the challenge this thing is how to determine whether the finger has touched the projected surface or not. Most researchers in this field have used Multi camera or the depth to find the relative distance between the finger and surface which is expected to touch.

Related Work

According to the authors Jun Hu et al.[1], stated that "The interactive projection system (IPS) is enabling the bare-finger touch interaction on regular on planer surface (walls, tables). The challenge of the bare-finger is to recover information from the 2-D image captured by the camera.

In this System finger is distorted by clicking it, and there is positive relation between button distortion and finger height to surface. The proposed touch detection algorithm is performed in three stages: mapping by Homography and extracting region of interest, distortion detection, and touch judgment. An objective assessment is performed on the virtual keyboard and the results prove that the proposed approach can detect bare-finger touch in real time with the missed detection rate of 1.00%, false detection rate of 2.08%, and touch detection rate of 96.92% at the typical projected distance. At the same time, the button's distortion detection, which was similar to canny edge detection, was robust to the shadows and finger's edge. Many applications on virtual keyboard show that the accuracy of the touch detection is 96.9% at the 40-cm projected distance, which was high enough for button-based applications. According to Pralhad Salunke [2] the work is to enable the bare-finger touch detection with only one camera, monitor and raspberry pi has been used. In this method, the GUI is created through the use of QT program so that when the fingers are moved it will be caught by the camera. This produced virtual control unit which is shown when fingers moved into the specific number zone, it will be recognized and showed on the presentation unit. It is proposed that the work is novel, quick and strong for features, which takes favorable position to distinguish the touch activity. To show the possibility of the system, a system model of uncovered finger touches is detected. A few average applications were situated up and probes the virtual console have proved that the proposed methodology can distinguish uncovered finger touch progressively. In future, this project will exploit the other realistic elements (e.g., character shape, symbol highlight) in the human – PC interface to identify touch cases on the virtual console screen. (B 2015).

Existing works

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Authors Name	Project Title	Component	Advantage	Disadvantage
Jun Hu, Guolin Li, Xiang Xie, Zhong lv, and Zhihu Wang	"Bare-finger Touch Detection by the Button's Distortion in a Projector-Camera System"	Projector and Camera.	Using the virtual keyboard on planner surface. Typing easy by hand.	The accuracy of the touch detection.
Pralhad Salunke and Ravatappa A B.	"Bare Finger Touch Detection on Virtual Keyboard Based on Raspberry Pi"	Projector, UVC Camera, Raspberry pi, Moues, keyboard, Monitor and HDMI.	Simply made out of a camera, screen and raspberry PI. Using hand touch for typing.	A small edge for the character, which could make an error while the image processing.
T.S.Kumaran, J.Arul Murugan and Mr.T.Sengolra jan.	"Bare Finger Touch Detection by Distortion in Project Camera System"	Projector, Camera, Raspberry pi, Bluetooth , HDMI.	Using the open to do image processing. using the Linux platform which removes	The size of the keyboard is limited depending upon the camera resolution. As the camera can cover only a certain

Table 1: shows the comparison

System Design

First step for any project is to put clear goals, which the project will be implemented through it. The goals which mentioned in the work is: It provides virtual keyboard on any planer surfaces for convenient touch action. Region of interest extraction through a Homography mapping, is use to reduce the computational complexity of the following process. The button's distortion detection is done with a special edge detection algorithm, which greatly reduces the errors in touch interaction due to the influence of the finger's shadows and edges. Touch action judgment is with button's distortion in virtual keyboard. This project is aim to help people typing easy with virtual keyboard. The mobile devices users suffering from a small keyboard use while they type long articles on computers. In order to reduce the pain in the fingers and to involve technologies development this small Keyboard is replaced to provide easy of writing with virtual keyboard. During this project the aim got some changes occur. Some of this changes such a new component are add which is laser pointer. This laser pointer will be using it for typing. The keyboard will be reflecting on a surface, and the character will be selected through the laser point and the camera will catch the laser point in the keyboard. Before the idea was the camera catch the movement of the finger and process it then write it. But the problem is in resolution of the camera, where the resolution of the use camera is weak.
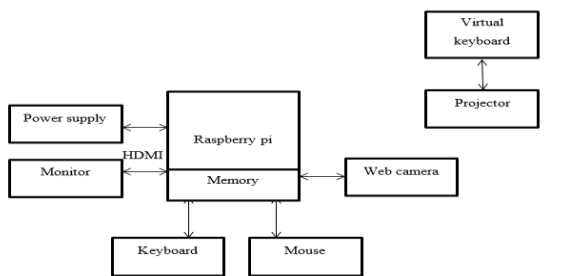

Figure 1: shows the block diagram of the process

So the camera face problem to process the movement of finger. The distance between the camera and the image of the

reflected keyboard must be fixed 83 cm as the coordinates (x, y) of this character taken at this distance. So this distance must not change or the coordinates (x, y) will change and then camera catches the wrong character.
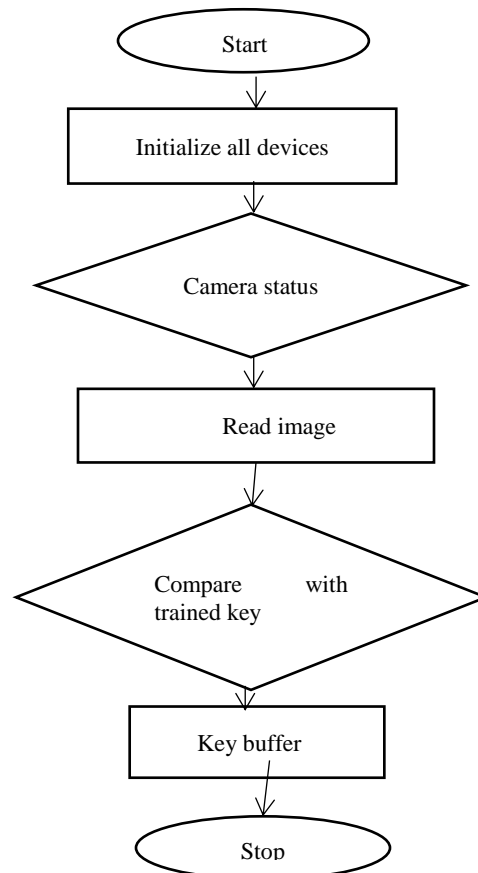

Figure 2: Shows the flowchart of the process

Simulation Results

Here the final connection of the project will be shown. Which is applied for the user who wants to write long message or articles in comfortable way. It is working with easy and clear idea, where the laser pointer point in the character that we want then the camera will catch that character and process it. After processing the text that we write will be shown in the open CV

Figure 3: projector connection

These figure show that the mini projector is connected to the power supply. Where the USB flash are insert it to the project

which stored inside it picture for the keyboard. The project is reflected the picture of the keyboard
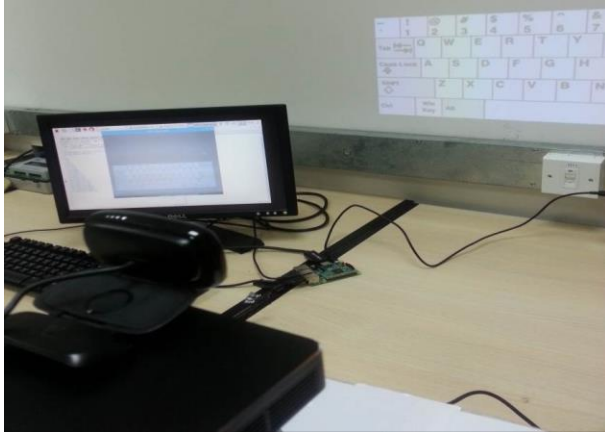

Figure 4: all components are connect together

In the previous photo the whole system are connect together. Where the next picture will shows that when the program code are run. Two window are be open in the screen on for what the camera shots and the other one for the open CV program.

Conclusion

At the end of this project, the general idea was to making the typing easy and comfortable in the mobile devices by using the virtual keyboard. This project is aim to provide the virtual keyboard on any planner surface for laser pointer action. In this project is little change where a new component is added. The users of the virtual keyboard just need to press on the laser pointer to the character that he wanted and this character will be capture by the camera. Then it will be processed in the open CV, after that the later it will be shown. At the end of writing of the text it will be read directly. Where chapter one is about the introduction which contain background of the project, objectives, project limitation and overview of the project report. Chapter two includes the methodology that shows the problem definition to the solution. Chapter three includes the literature review or theory which discusses similar project problem, suitable solution and technology support which can be incorporated in the present project.

Chapter four is budgeting and project management which contain project budget, project schedule and risk management. Chapter five is about design and analysis. It includes system initial design which has system block diagram and flow chart, technical requirement which contain hardware and software component, schematic diagram and system design and analysis. In the final chapter of this project report a conclusion is defined with proper understanding. Of the lesson that learned from the implementation project are that new component are used for the first time, so that give a chance to know more about it how to use it, what is contain of and how it connect like raspberry pi. Another lesson it has been learned is how to program a raspberry pi by using python language which is similar to C++ language with little different. At the end of this conclusion, to making this project better in the future it recommended to dispensing to the laser pointer and let the user to type using hand. Also, to designing the virtual keyboard in suitable and small shape to be carrying it easily where the users go.

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