

Bare Fingers Touch Detection on the Virtual Keyboard Based On the Raspberry Pi

¹Pralhad Salunke, ²Ravatappa A B

¹PG Student, DEC ²Assistant Professor

^{1,2}Department of ECE, Sambhram institute of technology Bengaluru, Karnataka, India

Abstract: In this paper, we propose a novel which enables the bare finger touch detection with only one camera, monitor and raspberry PI. In our technique, the graphical user interface (GUI) is created by utilizing the QT programming so when we move our fingers noticeable all around which will be caught by the camera. There is produced virtual console which is shown on the screen so when we move our fingers in air to the camera confront that time we can see our fingers on the virtual console, when fingers moved into the specific number zone, it will be recognized and showed on the presentation unit. In this manner, we propose a novel, quick, and Haar like feature, which takes favourable position to distinguish the touch activity.

Keywords: Hand gesture recognition, reduced Haar-like feature set, Human Computer Interaction (HCI).

I. INTRODUCTION

In present days Smartphones have turn into a fundamental piece of our life, enough that they have turn out to be practically irreplaceable in today's quick paced world. We have framed such an unbreakable association with our Smartphones that cybercriminals have included them in their rundown of focuses to assault for financial increase. For better or for more awful, cell phones have turn into an imperative piece of our day by day toolset forever.

We propose a novel and quicker framework for exposed finger touch location by utilizing Intel's picture preparing library Open CV. The methodologies are predominantly partitioned into Data-Glove based and Vision Based methodologies. The Data-Glove based system sensor gadgets for digitizing hand, collect hand design and development. Notwithstanding, these gadgets are truly extravagant and hard to oversee progressively environment because of its complex wired structure. Interchange Method is Vision Based, which is in view of late innovation of Computer vision. It doesn't require any gloves or other overwhelming contraption. This technique obliges just web camera to concentrates the feature outline. Today the vast majority of the portable PCs have a coordinated webcam alongside it so it is an effortlessly accessible gadget

Our framework uses Open CV picture handling library to perform the complete procedure from pre-processing to identification & following to highlight extraction lastly preparing and testing by HAAR calculation. Open CV based library makes the framework simple to make because of the substantial measure of inbuilt elements of different picture preparing undertakings like edge location, highlight following and so on., additionally being a C++ based library the frameworks similarity for constant applications is high with a quick handling pace.

II. SOFTWARE COMPONENTS

A. Linux Operating System:

The Linux OS, or Linux open source working framework, is cross-stage working framework, it is unreservedly distributable, and Linux OS is predominantly taking into account UNIX. This OS can be introduced on tablets, tablet and cell phones, Pcs, servers, supercomputers, feature diversion comforts and the sky is the limit from there.

B. Qt for Embedded Linux:

Qt for Embedded Linux is a C++ structure for graphical client Interface (GUI) and it is primarily utilized with the end goal of utilization advancement which is utilized as a part of implanted gadgets. It keeps running on implanted Linux typically furthermore keeps running on assortment of processors.

C. OPEN CV:

Open CV is an open source PC vision library initially grew by Intel. It is free for both scholastic and business utilization. It has C++, C, python and java interfaces, the library is cross-stage for Linux and keeps running on Linux, Windows and Mac OS X. It concentrates primarily to-wards constant picture handling, Open CV is fundamentally intended for computational productivity and with an in number concentrate on ongoing applications.

D. Framework:

The framework system comprises of three useful parts: scene catch, information handling and sound yield. The scene catch segment gathers scene containing objects of enthusiasm for the type of pictures or feature.

III. HARDWARE IMPLEMENTATION

A. Raspberry pi:

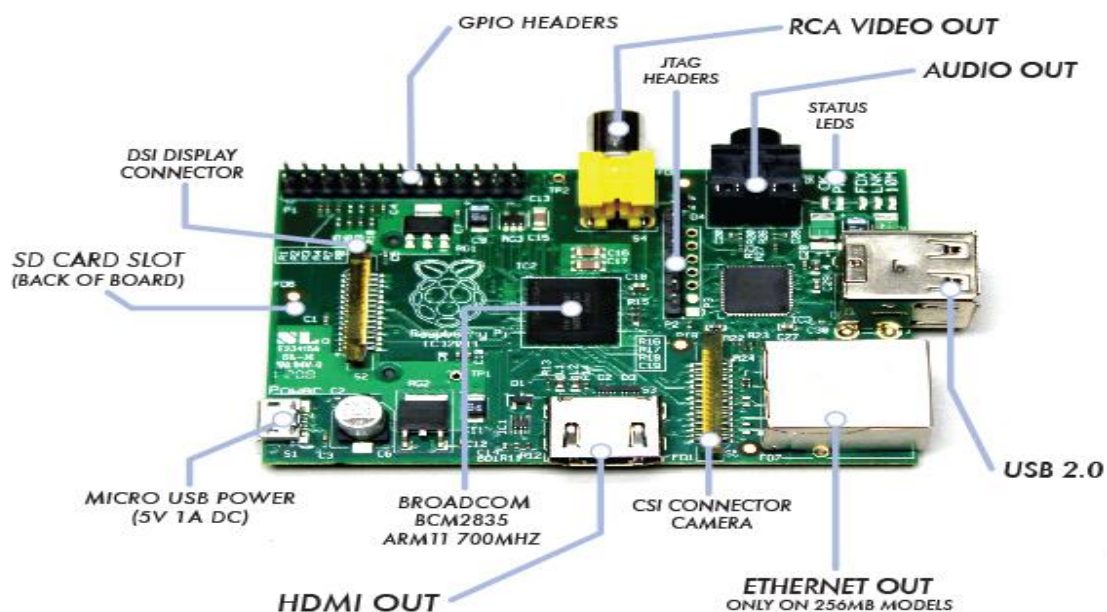


Fig.1.Raspberry Pi Development board

The Raspberry Pi grew in the UK by the Raspberry Pi Foundation, it is Master card estimated single-board PC, and it was produced to give best nature of information on essential software engineering with the expectation of advancing the educating schools.

The Raspberry Pi is a PC, it is much like the PCs with which we are now commonplace. It utilizes an alternate sort of processor, so we can't introduce Microsoft Windows on it. Anyhow, it chips away at a few adaptations of the Linux working framework that look and feel all that much like Windows. Raspberry Pi can be utilized to surf the web, send an email or compose a letter utilizing a word Processor and that's only the tip of the iceberg. Raspberry Pi board have taking after choices in there board 700Mhz ARM v6 Broad-comm. CPU+GPU 512 MB RAM, Boots off SD card for File-framework USB, Audio out, LAN,HDMI + Composite feature out GPIO pins Powered off 5V, ~700ma. The elements and alternatives of ports differ with relying upon model.

The board is extremely reasonable, open PC to help give children access to PCs that they could try different things with, in the same way as other of us did in the 1980's. Attaches to TV's, USB KB+mouse, fueled off PDA power connectors – things a large number of us have as of now. SD stock piling so natural to reflash in the event that we spoil it. Linux based OS, so natural to get in and perceive how it functions. Additionally has GPIO so conceivable to use for mechanical autonomy. Tremendous group taking after (Not valid for a significant number of these sorts of gadgets) Think Arduino famous (>1M units sold in the first year)

The unit utilized for the execution is a Raspberry PI board which contains different spaces for interfacing with the PC, headphone, power supply and the outside USB camera. The PC goes about as a remote to conjure the system demonstrate

B. Embedded Linux:

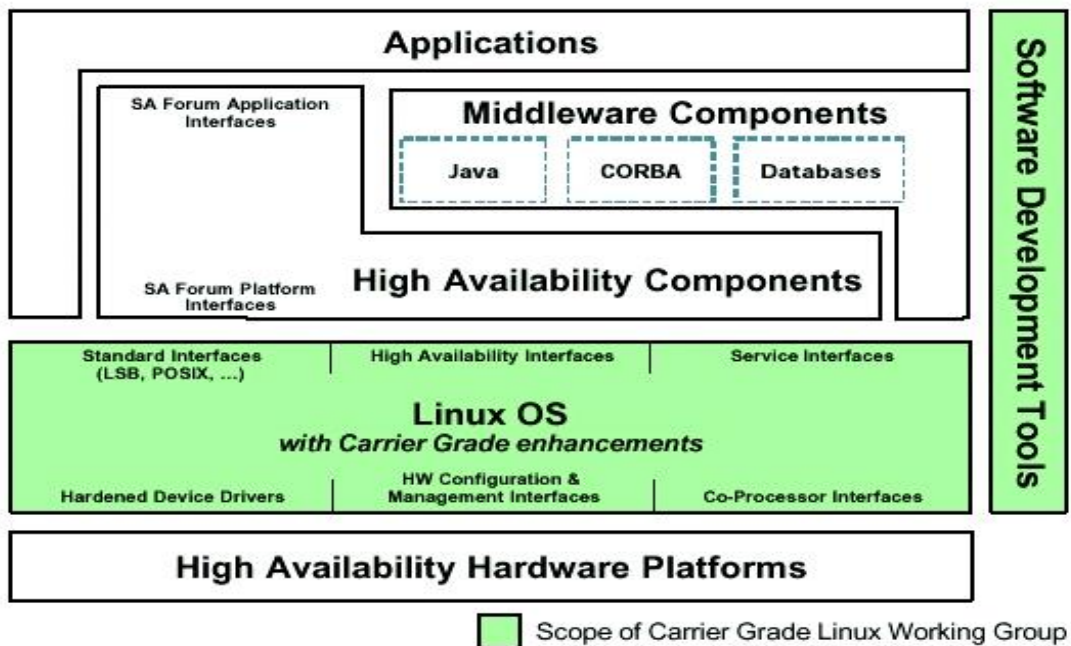


Fig 2. Architecture of Embedded Linux system

Inserted Linux is essentially has three layer initial one is Application programming layer which is in top, centre layer is Kernel (centre programming layer) these two layer cooperate with one another through APEX interface and last layer is Hardware. The application programming layer incorporate equipment gadgets and this additionally incorporate framework part and application parcel. Application parts comprise as a rule of one or more procedures which utilize intelligent application official interface for administration.

The centre segment of working framework is bit, which is in the middle of equipment and application programming layer, part is exceedingly compact between PC structural planning and equipment gadgets, it underpins an amazing assortment of equipment gadgets and drivers. The fundamental capacity is deal with the equipment in predictable way giving abnormal state unique to client level programming. This additionally obliges libraries and applications to give elements to end clients.

The fundamental part of the piece are deal with all the equipment assets like CPU, memory, I/O. part Provide an arrangement of compact, building design and equipment autonomous APIs to permit client space applications and libraries to utilize the equipment assets and Handle simultaneous gets to and use of equipment assets from diverse applications. These days, more than one thousand individuals add to every part discharge, people or organizations of all shapes and sizes.

A few elements of portion are Portability and equipment bolster, it keeps running on most architectures furthermore more adaptable can keep running on super PCs and additionally on small gadgets, it Compliance to norms and interoperability Exhaustive systems administration bolster, Linux piece Easy to program u can gain from existing code numerous valuable assets on the net.

IV. RELATED WORK

Touch identification on a projection screen is a vital issue in the region of human-computer connection. Throughout the most recent quite a long while, numerous methodologies have been proposed to take care of the issue. Harrison et al. [8] utilize a wearable, bio-acoustic detecting cluster incorporated with an armband to recognize touch activity on the skin, and Kane et al's. Bonfire [9] applies an accelerometer to distinguish the increasing speed produced by the fingers' snap. Both routines require extra hardware and are touchy to ecological impacts. Range data gave by two or more cameras

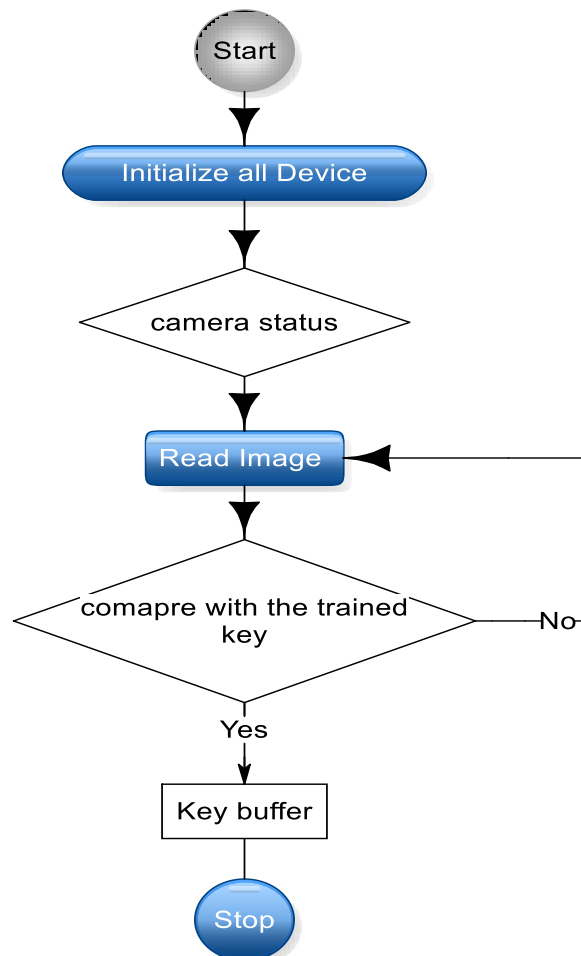
extraordinarily enhances the exactness of touch identification. In Moet al's. SmartCanvas [3], one camera is utilized to track the finger's direction and other one is set parallel to the surface, to recognize whether the finger touches the surface. Korkaloet al. [26] utilize different cameras, which are put as an afterthought of the LCD show with their optical hub parallel to the screen, to recognize touch occasions and focus the position of touch on the screen. The shadows of the fingers can be utilized to perceive touch activity. Liet al. [30] set forward a Gaussian blend model to identify shadows. Wilson et al. [10] and Chanet al. [11] apply infrared light and a camera to catch the hand and evaluation the touch by abusing the shadow cast by the fingers. The extraction of the fingertip is straightforward, precise, and powerful, yet helper hardware is required in the framework. As of late, profundity detecting cameras have turn out to be extremely prevalent in recognizing touch. Benkoet al. [4] and Wilson et al. [12] talk about the utilization of the profundity detecting camera to empower freehand cooperation on surface. Additionally, Harrison et al. [5] and Murugappan et al. [27] propose utilizing Microsoft Kin et to acquire the separation between the fingertip and the surface.

The identification of a catch's mutilation can be completed utilizing edge recognition. In PC vision and picture preparing, edge identification is an adult innovation. Approaches for actualizing first- and second-arrange computerized subsidiaries for the location of edges in a picture are exceptionally powerful [13]

V. APPLICATION ARCHITECTURE DESIGN

The application utilizes a mix of distinctive PC vision methods for hand motion acknowledgment. It perceives static hand signals. Figure 4 demonstrates the application structural planning configuration for controlling virtual items utilizing hand signals.

Pictures are caught from camera and went through after stages/strategies .Starting with the procurement stage that is the first stage. Since a standard data fringe (console, directing gadget) will be unsatisfactory in this application setting. So we have concentrated on conceivable choices by considering brilliant interfaces that have been propelled by normal conduct of the clients in genuine activities.



At the point when the model begin all the gadgets will be get instated after that camera will get watched that is whether the camera is turned on or not all that once the camera get turned on it will read the pictures and hope to measure up with the prepared key, in the event that it establishes the match it will demonstrates the coordinated key in the key support generally pick up it will read the picture and checks whether it will get coordinated with the prepared key.

VI. BLOCK DIAGRAM

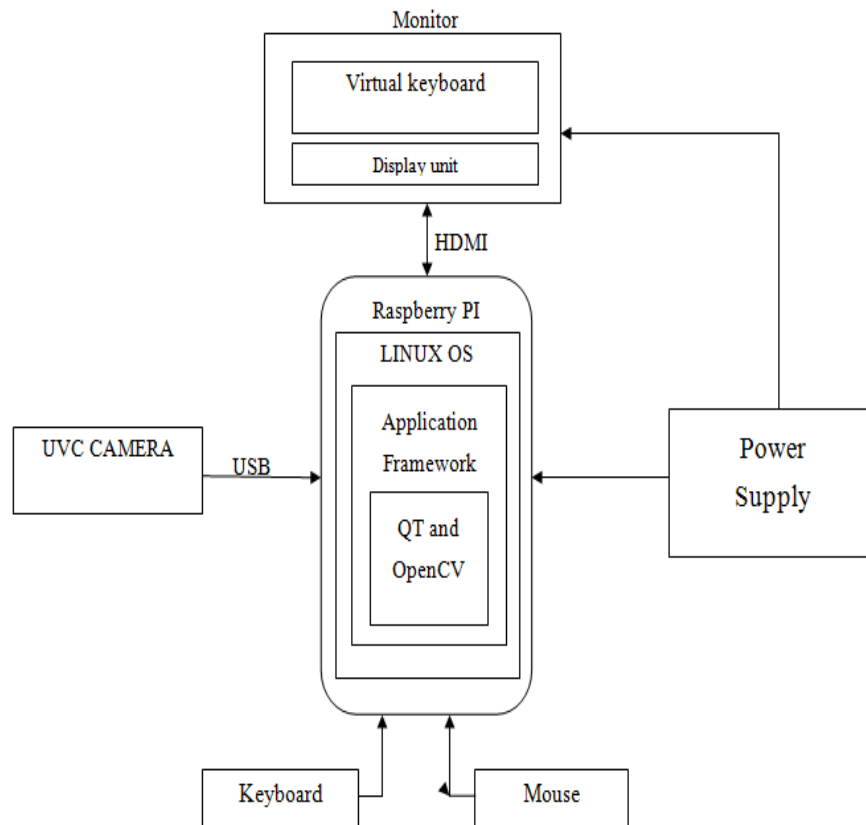


Fig.3 bare fingers touch detection on virtual keyboard

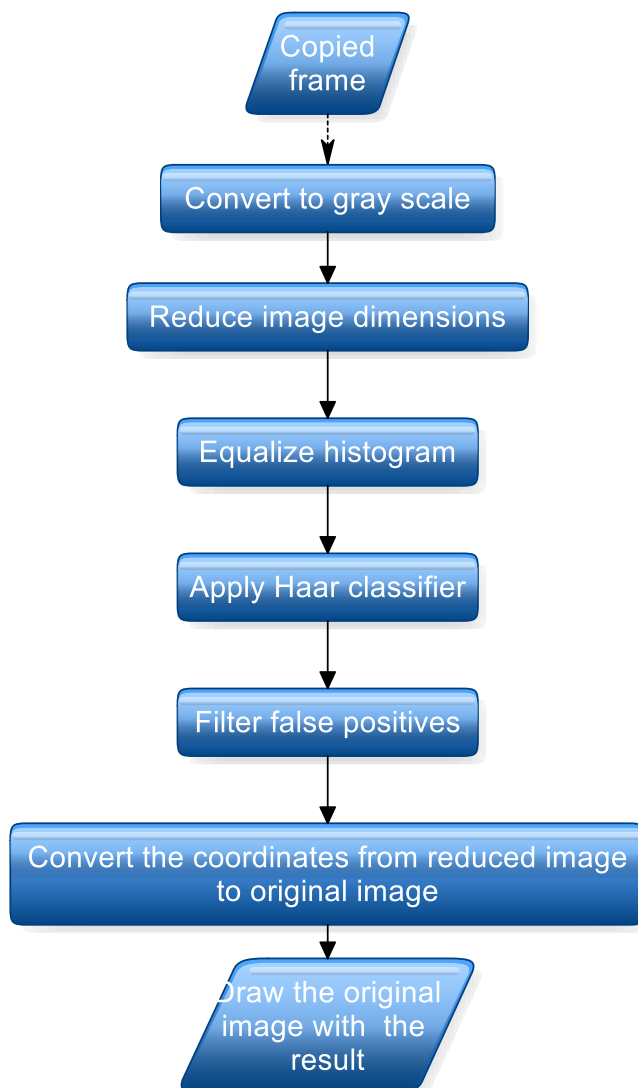
Before running the application it first check all the gadgets and assets which it needs are accessible or not. After that it checks the association with the gadgets and offers control to the client. The GUI for the client has the accompanying alternatives.

A discretionary name is utilized for showing the picture taken from the camera. For speaking to the identified information from the picture a status box will be utilized. The catch is to distinguish the information from the picture.

Coming to distinguish catch, it is to identify the human from the feature spilling before the camera. The sound jack port is the yield port here. The Raspberry board accompanies coordinated peripherals like ADC, USB and Serial and so on.

Organizing conventions and record framework sorts both are prime cases of wellsprings of organized information which require by piece to comprehend and communicate with so as to give access to information going to and originating from these sources. "TFT Display remains for Thin Film Transistor show", and is a kind of innovation which is utilized to enhance the picture nature of a LCD. Every single pixel on a TFT-LCD has its own transistor on the glass itself and which offers more control over the pictures and hues that it renders. "TFT-LCDs" can convey sharp pictures, they likewise have a tendency to offer generally which are poor in diverse review points, importance they look plainly best when seen head-on. On the off chance that you are going to view a TFT-LCD from the side edge, it can be hard to see, can't get the reasonable perspective of the picture.

VII. HAAR ALGORITHM



There are two examples in the calculation to be specific positive and negative specimens. In the positive example there will be a comparable shape to the custom item. The calculation is essentially in view of to identify the any sort of article (e.g. Pen, Face, fingers, and so forth) it is going to concentrate the edge esteem from the picture worth like double values. How precisely its going to happen implies at first it will change over the picture into the dim scale picture and again in the dark scale it will going to change over into paired picture. There is a H identification that will happen here, in the H recognition it will evacuate the undesirable part in the picture and forgot with the needed picture later it will coordinate it with the positive example, there are now values are prepared and put away into the xml form, all limit qualities put away into the edge group. The xml form which is produced by the Haar prepared, this is having all our hand related structure.

VIII. APPLICATIONS

With IPS giving the capacity of touch recognition, numerous applications, for example, "slide to open," force point (PPT) seeing, and virtual console are created in this paper. The attainability of our proposed discovery system is exhibited by these applications.

A. Slide to Unlock:

The "slide to open" highlight is regular in cell phones, which is utilized to counteract coincidental operation. When it meets expectations, the project distinguishes the contortion of the long catch in the picture succession. At that point the finger's position and the finger's stature can be computed. As seen in Fig. 10, the framework is opened when client's finger slides from left to right.

B. PPT Viewing:

The communication with the PPT page is valuable for making a presentation. Case in point, for swinging to the following page, you may need to remain before your PC and press the console or mouse. In this period, the groups of onlookers' consideration may be exchanged by your activity. On the off chance that you can work straightforwardly on the anticipated PPT slide, the nature of your report will be progressed.

Here, we by and large present the essential standard of the PPT seeing. A 200×480 pixel zone on the right half of the PPT page is characterized as a dynamic region. Nothing is anticipated on the range until the finger shows up around there. The finger can be distinguished just through foundation subtraction [23]. At that point the unmistakable intuitive catches (e.g., next page, past page, and so forth.) are enacted.

C. Virtual Keyboard:

Virtual console is another fascinating application. It is uncomfortable for us to data message on the cell's screen as a result of its little console. In our application, IPS ventures the console on the table and backings the best approach to specifically sort on it (Fig. 12). For instance, when we need to make an impression on some individual on the left half of the screen, we click his or her representation. At that point the console shows up and touch cooperation is identified by the bending of the key.

IX. EXPERIMENT AND RESULT

A. Software Introduction:

Here this test is produced on open source library for PC vision application called Open Computer Vision Library (Open CV). The Open CV library is fundamentally utilized as a part of HCI, apply autonomy, picture preparing, biometrics and different regions where representation is vital. This product is exceptionally prevalent for Real time picture handling applications, for example, object discovery & motion acknowledgment. Here Open CV is received in light of the fact that there are a few points of interest and significant point of preference is that one can undoubtedly coordinate the code with equipment. We execute the proposed framework on Open CV library in light of Linux environment.

B. Experiment:

In the proposed strategy, we will go to create the virtual console and presentation unit by doing the edge work utilizing the QT programming. Show unit will give the uncovered finger touch distinguished yield.

To accomplish this objective we will move our fingers noticeable all around which will be caught by the camera. There is a produced virtual console which is shown on the screen so when we move our fingers in air to the camera confront that time we can see our fingers on the virtual console, when fingers moved into the specific number zone it will identified and showed on the presentation unit.

C. Result:

The proposed methodology can identify exposed finger touch continuously with great effectiveness. Beneath figures will demonstrate the after effect of the uncovered finger touch discovery.



Fig.1 Prototype of bare finger touch detection

The above figure demonstrates the model of the uncovered finger touch location on the virtual keyboard. We see the all equipment components which are utilized for this model, it comprises of camera, screen, raspberry pi.

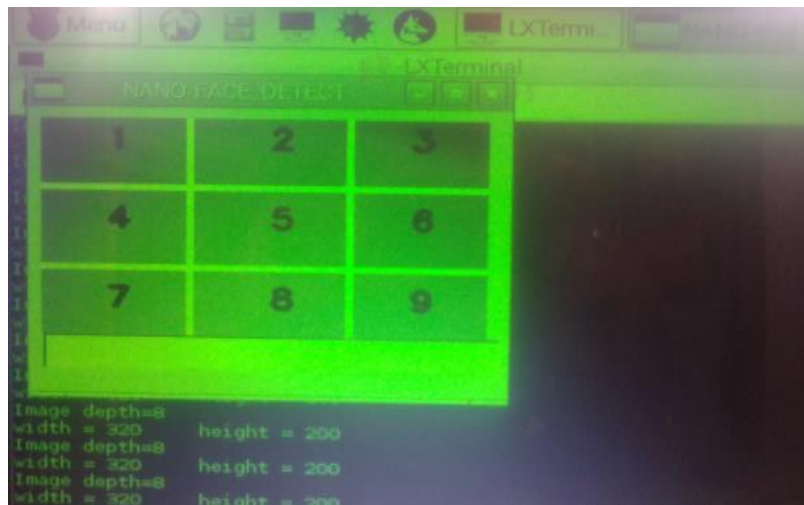


Fig.2 virtual keyboard

The above figure demonstrates the virtual console which is made by utilizing the openCV library and QT programming to developed it, on this virtual console we can sort by the hand motion.

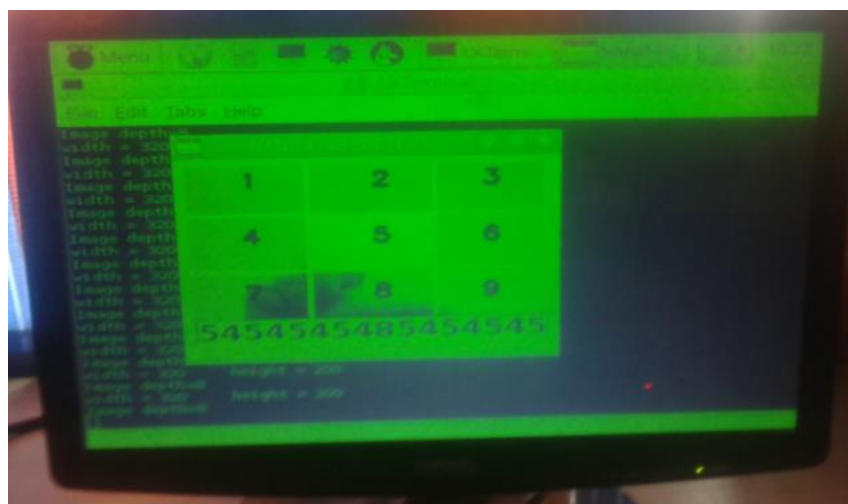


Fig.3 Bare finger touched number output on the display unit

The above figure demonstrates how the number will get wrote by the uncovered finger by utilizing the hand motion system furthermore we can see the wrote numbers at the base of the virtual console that is on the presentation unit.

X. CONCLUSION

In this paper, the uncovered finger touch location will be recommended that is simply made out of a camera, screen and raspberry PI. To accomplish this objective we need to move our fingers noticeable all around which will be caught by the camera. There is outlined virtual console which is shown on the screen so when we move our fingers in air to the camera confront that time we can see our fingers on the virtual console, when fingers moved into the specific number zone it will be distinguished and showed on the showcase unit.

Most importantly, to show the achievability of the system, an equipment model of uncovered finger touches discovery. A few average applications were situated up and probes the virtual console have demonstrated that the proposed methodology can distinguish uncovered finger touch progressively.

Later on, we will exploit the other realistic elements (e.g., character shape, symbol highlight) in the human- PC interface to identify touch occasions on the virtual console screen.

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