VIRTUAL PIANO

Capstone Project Report

Fifth Mentor Evaluation

Submitted by:

(101683035) Akshay Sharma

(101683033) Abhi Mahajan

(101503008) Abhishek Sharma

BE Third Year, CSE

CPG No: 84

Under the Mentorship of

Dr Singara Singh

Associate Professor

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Computer Science and Engineering Department

TIET, Patiala

September 2018

TABLE OF CONTENTS

LIST OF FIGURES

EXPERIMENTATION DETAILS

We are experimenting this Virtual Piano on different test cases. There are majorly two types of test cases- basic test cases and corner test cases. The basic test cases include placing the finger (single finger or multiple fingers) on different segments of piano and checking whether correct tone is coming or not and also verifying the output from LCD screen display. The corner test cases include testing on single finger detection, double finger detection and multi finger detection.

For testing on single finger, we are testing by placing the finger on first segment i.e Segment C, the middle segment i.e Segment F and on the last segment, i.e Segment B at different time intervals. For the detection of double fingers, we will be placing the finger on first and last segment i.e Segment C and Segment B, middle two segments i.e Segment F and Segment G and at any two segments, say Segment B and Segment G. This virtual piano can also detect for multiple fingers. For testing this, we have taken many test cases like three segments, four segments, five segments, six segments, etc. In multi-finger detection, we have even included the test cases for detection of fingers in continuous manner as well as detection of fingers in non-continuous manner. The test cases include placing the fingers on three continuous segments i.e Segment B, Segment A and Segment G and again on further three continuous segments i.e Segment F, Segment E and Segment D. We now placed our fingers on three non-continuous segments i.e Segment B, Segment G and Segment C and again on further three non-continuous segments i.e Segment G, Segment F and Segment D. Now we placed our fingers on four segments i.e Segment A, Segment G, Segment F and Segment E and further again on different four segments including Segment G, Segment F, Segment E and Segment D. After the successful detection of four fingers by our virtual piano, we moved towards testing the detection of five fingers by our virtual piano. We now placed our fingers on five different segments i.e Segment A, Segment G, Segment F, Segment E and Segment D. After this we tested the Virtual Piano for the detection of six fingers. We placed our fingers on Segment B, Segment A, Segment G, Segment F, Segment E and Segment D.

It is not necessary to place our fingers on a particular segment for the specified tone to be played. We have used Image Processing to divide our semi-transparent plastic sheet into different segments. Even if we will not place our fingers on a segment and instead place our fingers in the air, the tone will still be played. The semi-transparent plastic sheet has been designed for a beginner so that he can understand the importance of these segments as then he will get the same feeling as he will get while working on an actual piano.
The Virtual Piano is designed in such a manner so that it remains in accordance with the actual piano. With music, there are many different strategies that can help you move quickly to a better understanding. Everyone approaches music differently. Some beginners intuitively grasp complex concepts, others need a little help along the way. Our main aim for designing this virtual piano was to make the beginners understand the complex concepts of piano in an interactive manner getting the taste of technology along with the feel of actual piano.

In all the test cases specified above, our project works perfectly fine. In all of the above specified test cases, the tone is being played corresponding to the detected segment. The same is verified by the LCD Screen display as well. When the tone was being played corresponding to the detected segment, the same segment was displayed on LCD Screen as well. Our main aim was to test the project on exhaustive test cases. We did the same and tested our project on all possible exhaustive test cases specified as above. On all of these exhaustive test cases, we were getting the correct required output.

Test Plan

- Single Finger Detection
  - Finger placed at first segment
  - Finger placed at middle segment
  - Finger placed at last segment
- Double Finger Detection
  - Fingers placed at first and last segment
  - Fingers placed at middle two segments
  - Fingers placed at any two segments
- Multi Finger Detection

Single Finger Detection

- Finger placed at first segment i.e Segment C

Test Result:

Sound is being played corresponding to segment C and the same is being displayed on the LCD screen.

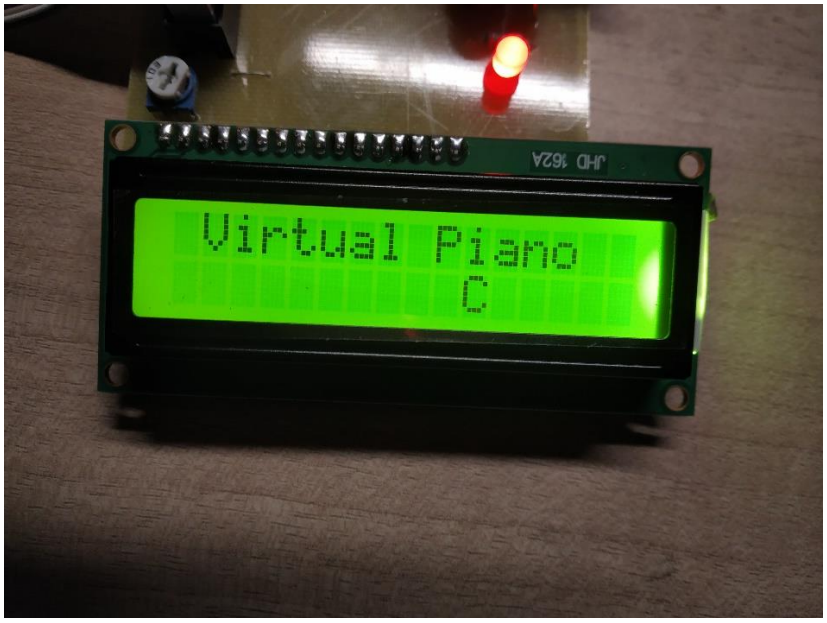

Figure 1: Output obtained when finger is placed at Segment C

- Finger placed at middle segment i.e Segment F

Test Result:

Sound is being played corresponding to segment F and the same is being displayed on the LCD screen.

Figure 2: Output obtained when finger is placed at Segment F

- Finger placed at last segment i.e Segment B

Test Result:

Sound is being played corresponding to segment B and the same is being displayed on the LCD screen.

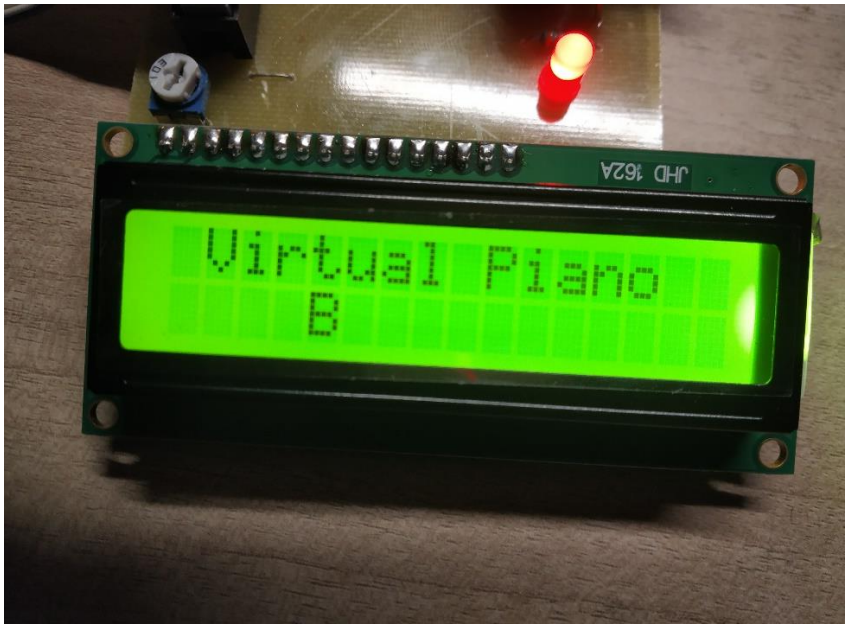

Figure 3: Output obtained when finger is placed at Segment B

Double Finger Detection

- Fingers placed at first and last segment i.e Segment B and Segment C

Test Result:

Sound is being played corresponding to Segment B and Segment C and the same is being displayed on the LCD screen.

Figure 4: Output obtained when fingers are placed at Segment B & C

- Fingers placed at middle two segments i.e Segment G and Segment F

Test Result:

Sound is being played corresponding to Segment G and Segment F and the same is being displayed on the LCD screen.

Figure 5: Output obtained when fingers are placed at Segment G & F

- Fingers placed at any two segments, say Segment A and Segment D

Test Result:

Sound is being played corresponding to Segment A and Segment D and the same is being displayed on the LCD screen.

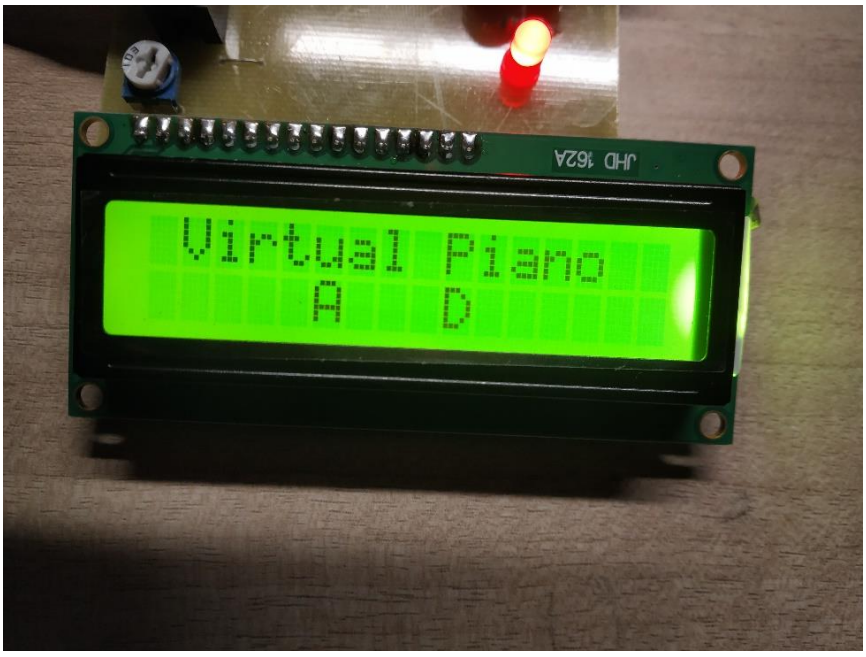

Figure 6: Output obtained when fingers are placed at Segment A & D

Multi Finger Detection

- Fingers placed at three segments, say Segment B, Segment A and Segment G

Test Result:

Sound is being played corresponding to Segment B, Segment A and Segment G and the same is being displayed on the LCD screen.

Figure 7: Output obtained when fingers are placed at Segment B, A & G

- Fingers placed at three segments, say Segment F, Segment E and Segment D

Test Result:

Sound is being played corresponding to Segment F, Segment E and Segment D and the same is being displayed on the LCD screen.

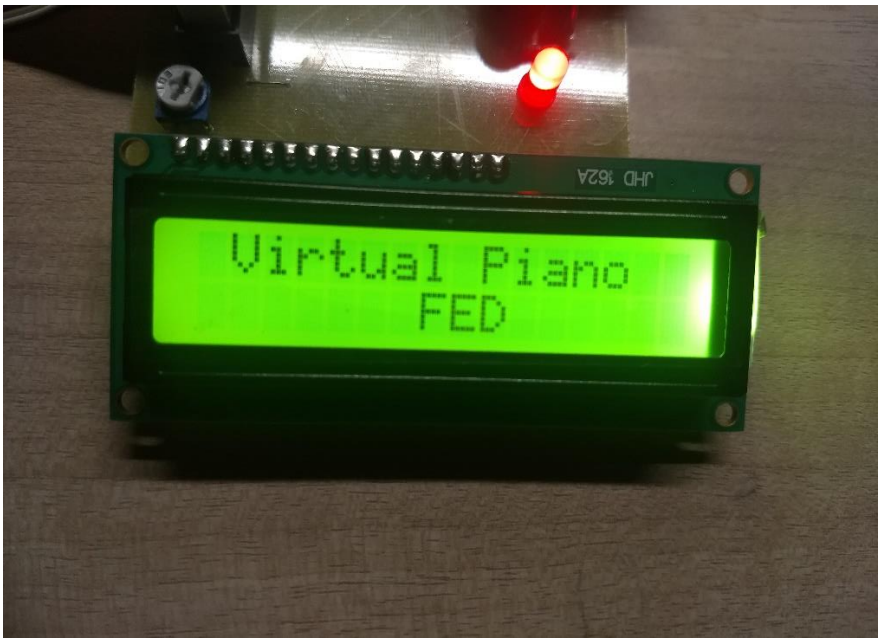

Figure 8: Output obtained when fingers are placed at Segment F, E & D

- Fingers placed at three non-continuous segments, say Segment B, Segment G and Segment C

Test Result:

Sound is being played corresponding to non-continuous Segment B, Segment G and Segment C and the same is being displayed on the LCD screen.

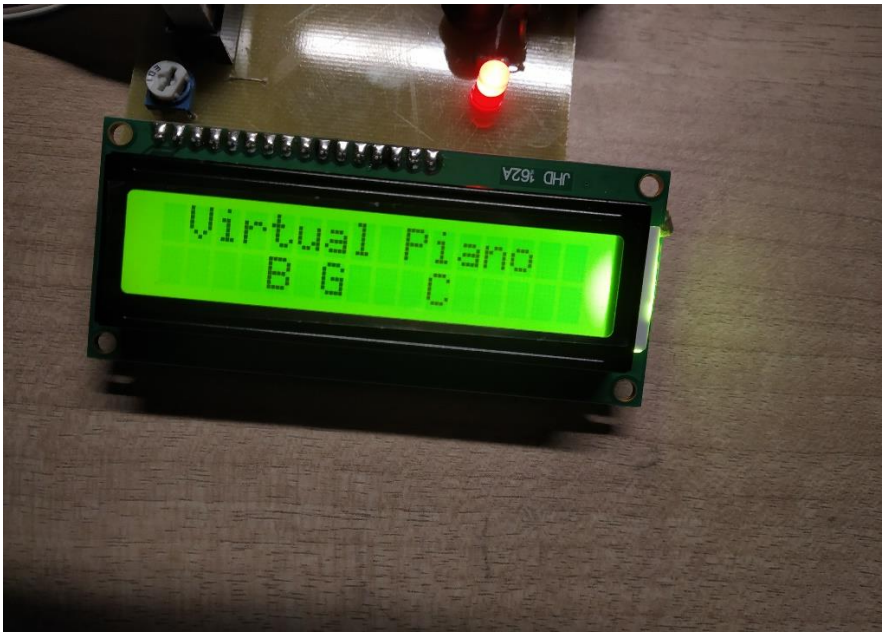

Figure 9: Output obtained when fingers are placed at Segment B, G & C

- Fingers placed at three non-continuous segments, say Segment G, Segment F and Segment D

Test Result:

Sound is being played corresponding to non-continuous Segment G, Segment F and Segment D and the same is being displayed on the LCD screen.

Figure 10: Output obtained when fingers are placed at Segment G, F & D

- Fingers placed at four segments, say Segment A, Segment G, Segment F and Segment E

Test Result:

Sound is being played corresponding to Segment A, Segment G, Segment F and Segment E and the same is being displayed on the LCD screen.

Figure 11: Output obtained when fingers are placed at Segment A, G, F & E

- Fingers placed at four segments, say Segment G, Segment F, Segment E and Segment D

Test Result:

Sound is being played corresponding to Segment G, Segment F, Segment E and Segment D and the same is being displayed on the LCD screen.

Figure 12: Output obtained when fingers are placed at Segment G, F, E & D

- Fingers placed at five segments, say Segment A, Segment G, Segment F, Segment E and Segment D

Test Result:

Sound is being played corresponding to Segment A, Segment G, Segment F, Segment E and Segment D and the same is being displayed on the LCD screen.

Figure 13: Output obtained when fingers are placed at Segment A, G, F, E & D

- Fingers placed at six segments, say Segment B, Segment A, Segment G, Segment F, Segment E and Segment D

Test Result:

Sound is being played corresponding to Segment B, Segment A, Segment G, Segment F, Segment E and Segment D and the same is being displayed on the LCD screen.

Figure 14: Output obtained when fingers are placed at Segment B, A, G, F, E & D

REFERENCES

[1] A. Oka and M. Hashimoto, "Marker-less piano fingering recognition using sequential depth images", 19th Korea-Japan Joint Workshop on Frontiers of Computer Vision, pp. 1-4, 2013.

[2] M. Sotirios and P. Georgios, "Computer vision method for pianist's fingers information retrieval," presented at the Proceedings of the 10th International Conference on Information Integration and Web-based Applications & Services, Linz, Austria, pp. 5-8, 2008.

[3] C.-C. Lin and D. S.-M. Liu, "An intelligent virtual piano tutor," in Proceedings of the ACM international conference on Virtual reality continuum and its applications, Hong Kong, China, pp. 3-8, 2006.

[4] C. Deaker and R. Green, "A Computer Vision Method of Piano Tutoring, Without the Piano," Canterbury University, pp. 2-4, 2011.

[5] C.-H. Yeh, W.-Y. Tseng, J.-C. Bai, R.-N. Yeh, S.-C. Wang, and P.-Y. Sung, "Virtual Piano Design via Single-View Video Based on Multifinger Actions Recognition," the 3rd International Conference on Human-Centric Computing, pp. 1-5, 2010.

[6] F. Huang, Y. Zhou, Y. Yu, Z. Wang, and S. Du, "Piano AR: A Markerless Augmented Reality Based Piano Teaching System", International Conference on Intelligent Human-Machine Systems and Cybernetics, pp. 47-52, 2011.

[7] D. O. Gorodnichy and A. Yogeswaran, "Detection and tracking of pianist hands and fingers", the 3rd Canadian Conference on Computer and Robot Vision, pp. 62-63, 2006.

[8] K. Huang, E. Y. L. Do, and T. Starner, "PianoTouch: A wearable haptic piano instruction system for passive learning of piano skills, 12th IEEE International Symposium on Wearable Computers, pp. 41-44, 2008.