Development of a Portable Device for Students' Attendance Marking Based on Facial Recognition.

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ABSTRACT

Today, a wide variety of institutions, including colleges, industries, offices, and schools, use identifying techniques for access control and attendance collection of their students/employers. These identification methods include handwritten signatures, punch cards, fingerprints, facial recognition systems, etc. Among these, the facial recognition technique has grown in acceptance. However, the majority of Sri Lankan universities, colleges and academic institutions continue to use the outdated method of gathering student attendance, which entails obtaining their handwritten signatures on an attendance sheet. When using with students, this strategy has a number of practical problems [1] such as distracting the student and lecturer during the exam or lecture, wasting resources, and illegally signing on behalf of another student. In order to overcome these drawbacks, this paper presents a low-cost, portable device to collect students' attendance using a facial recognition system. The proposed device uses a web camera and a Raspberry Pi module (the embedded system) to capture images, which are then processed to identify the student. When developing the code, the following steps were followed. 1)Capture the image of the student. 2)Load the student image and extract the facial features. 3)Recognize the face using the face recognition library.4) Use 'Openpyxl' to create workbooks with the required column names, then mark attendance on the Excel sheet. 5) Capture the object file (dataset_faces.dat) in Python. 6) Run different scripts by clicking buttons.

The "dlib" library in Python was utilized for the face detection part, due to its higher accuracy in a variety of situations, including detecting faces with face masks, beards and identical twins. Dlib library is an open-source C++ library that provides machine learning algorithms, including classification, regression, clustering, data transformation, and structured prediction. It has shown an accuracy of 99.38% [2] on the Labeled Faces in the Wild (LFW) dataset. Labeled Faces in the Wild is a public benchmark for face verification, also known as pair matching [3]. The "OpenCV" library can be used to implement the image capture program. The system records the student's attendance once it has identified them. The Python 'Tkinter' library was used as the user interface, making it simple to use the device screen. The system has several unique features compared to other products currently available on the market, such as portability, having a simple, user-friendly graphical user interface (GUI), cost-effectiveness, ability to use with any available Wi-Fi network for data logging, and capability of face recognition even with the face mask, which enables this device to use in a situation such as COVID 19 epidemic. Also, this device is equipped with an inbuilt rechargeable battery pack which eliminates the requirement for an additional power supply. Even though there are only a few products with similar features on the market, they are more expensive than the proposed product.

The system was able to identify the same person (male or female) during the experimental stage under various test conditions, including different facial expressions, hairstyles, headwear, angles, backgrounds, with/without spectacles, and with/without a face mask; however, the system produced unacceptable results due to poor lighting and the use of a low-quality web camera. By eliminating backdrop challenges like connecting a light source to the system, then it can control the environment's varying levels of illumination, or by connecting a high-quality web camera with low-light and adjustable light correction capabilities, the system can acquire accurate facial detection.

Keywords—Facial Recognition, Attendance marking, Raspberry Pi

REFERENCES

[1] D. Dassanayake and W. Wanniarachchi, "Challenges of Manual Attendance System Towards Student Motivation," pp. 516–525, 2021, [Online]. Available: http://ir.kdu.ac.lk/handle/345/5245%0Ahttp://ir.kdu.ac.lk/bitstream/handle/345/5245/60.pdf?sequence=1&isAllowed=y

[2] D. King, "High Quality Face Recognition with Deep Metric Learning," Dlib C++ Library, 12 Ffebruary 2017. [Online]. Available: http://blog.dlib.net/2017/02/high-quality-face-recognition-with-deep.html.

[3] "Labeled Faces in the Wild," 29 01 2018. [Online]. Available: http://vis-www.cs.umass.edu/lfw/.