International Journal of Scientific Research and Engineering Development-– Volume 7 Issue 2, Mar- Apr 2024
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Revolutionizing Attendance Tracking Acutting-Edge Facial Recognition System Implemented on Raspberry PI

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Abstract
In the rapidly evolving landscape of technology, the need for efficient and secure attendance management systems has become paramount. This project introduces a sophisticated solution employing face recognition technology on the Raspberry Pi platform to address this requirement. The system begins by capturing and storing images of authorized individuals during the initial setup phase. These images are then stored in a secure database, forming the foundation for subsequent attendance tracking. The uniqueness of the proposed system lies in its utilization of the OpenCV library to implement a face recognition mechanism. The system maps facial features into a coordinate structure, enabling precise detection of faces using a Multi-task Cascade. Raspberry Pi serves as the central component of this project, offering a cost- effective and energy-efficient solution. The lightweight and compact nature of the Raspberry Pi make it an ideal choice for deployment in educational institutions, businesses, or any setting where attendance monitoring is essential. The integration of face recognition on Raspberry Pi ensures a seamless and user-friendly experience for both administrators and end-users. The attendance process is streamlined, with the system automatically marking the attendance and recording the entry time when a registered individual enters the premises. This not only reduces the administrative burden associated with traditional attendance methods but also enhances the overall security.

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I. INTRODUCTION

The technology aims in imparting a tremendous knowledge oriented technical innovations these days. Deep Learning is one among the interesting domain that enables the machine to train itself by providing some datasets as input and provides an appropriate output during testing by applying different learning algorithms. Nowadays Attendance is considered as an important factor for both the student as well as the teacher of an educational organization. With the advancement of the deep learning technology the machine automatically detects the attendance performance of the students and maintains a record of those collected data. In general, the attendance system of the student can be maintained in two different forms namely,

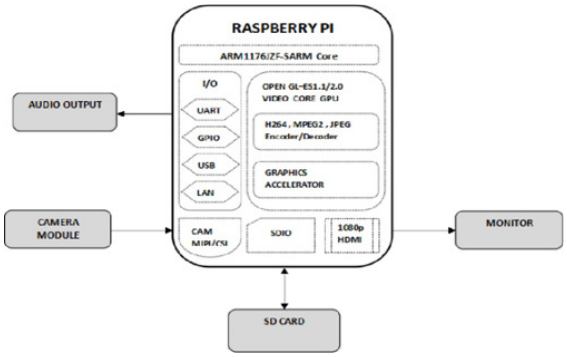
- Manual Attendance System (MAS)
- Automated Attendance System (AAS).

Manual Student Attendance Management system is a process where a teacher concerned with the particular subject need to call the students name and mark the attendance manually. Manual attendance may be considered as a time-consuming process or sometimes it happens for the teacher to miss someone or students may answer multiple times on the absence of their friends. So, the problem arises when we think about the traditional process of taking attendance in the classroom. To solve all these issues we go with Automatic Attendance System(AAS), Automated Attendance System (AAS) is a process to automatically estimate the presence or the absence of the student in the classroom by using face recognition technology. It is also possible to recognize whether the student is sleeping or awake during the lecture and it can also be implemented in the exam sessions to ensure the presence of the student. The presence of the students can be determined by capturing their faces on to a high-definition monitor video streaming service, so it becomes highly reliable for the machine to understand the presence of all the students in the classroom. The two common Human Face
Recognition techniques are,

- Feature-based approach
- Brightness-based approach.

The Feature-based approach also known as local face recognition system, used in pointing the key features of the face like eyes, ears, nose, mouth, edges, etc., whereas the brightness-based approach also termed as the global face recognition system, used in recognizing all the parts of the image.

BLOCK DIAGRAM



II.PROBLEM DEFINITION

The problem arises when we think about the traditional process of taking attendance in the classroom. To solve all these issues we go with Automatic Attendance System(AAS). Automated Attendance System (AAS) is a process to automatically estimate the presence or the absence of the student in the classroom by using face recognition technology. It is also possible to recognize whether the student is sleeping or awake during the lecture and it can also be implemented in the exam sessions to ensure the presence of the student. The presence of the students can be determined by capturing their faces on to a high-definition monitor video streaming service, so it becomes highly reliable for the machine to understand the presence of all the students in the classroom. The two common Human Face Recognition techniques are Feature-based approach and Brightness- based approach. The Feature-based approach also known as local face recognition system, used in pointing the key features of the face like eyes, ears, nose, mouth, edges, etc., whereas the brightness-based approach also termed as the global face recognition system, used in recognizing all the parts of the image.

III.SYSTEM STUDY

EXISTING SYSTEM

Existing System:

The existing system for attendance management typically relies on manual methods or basic automated systems such as card-based or fingerprint-based attendance systems.

Manual Attendance:

Traditional Methods

Attendance is often recorded manually, involving physical registers or sheets.

Time-Consuming

Manual attendance tracking can be time-consuming, especially in large institutions.

Automated Attendance:

Card-based Systems

Some institutions use ID cards with barcodes or RFID for automated attendance.

Fingerprint Scanners

Biometric systems, especially fingerprint scanners, are employed for automated tracking.

IV.PROPOSED SYSTEM

The proposed system is to capture the face of each student and to store it in the database for their attendance. In this system, there is no need for the teacher to manually take attendance in the class. The automated systems developed to overcome these difficulties, have drawbacks like cost, fake attendance, accuracy, intrusiveness.

The proposed attendance management system aims to simplify the tracking process by employing face recognition technology. Each student's face will be automatically captured and stored in a secure database, eliminating the need for manual attendance taking by teachers. This system offers a cost-effective solution, leveraging technologies like Raspberry Pi, while addressing common drawbacks such as fake attendance attempts and intrusive methods found in existing systems. With real-time tracking and user-friendly interfaces, it provides an efficient and non-intrusive way to

V.SYSTEM TESTING

INTRODUCTION

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. In fact, testing is the one step in the software engineering process that could be viewed as destructive rather than constructive.

A strategy for software testing integrates software test case design methods into a well-planned series of steps that result in the successful construction of software. Testing is the set of activities that can be planned in advance and conducted systematically. The underlying motivation of program testing is to affirm software quality with methods that can economically and effectively apply to both strategic to both large and small-scale systems.

STRATEGIC APPROACH TO SOFTWARE TESTING

The software engineering process can be viewed as a spiral. Initially system engineering defines the role of software and leads to software requirement analysis where the information domain, functions, behavior, performance, constraints and validation criteria for software are established. Moving inward along the spiral, we come to design and finally to coding. To develop computer software we spiral in along streamlines that decrease the level of abstraction on each turn.

Unit Testing

Unit testing focuses verification effort on the smallest unit of software design, the module. The unit testing we have is white box oriented and some modules the steps are conducted in parallel.

1.WHITE BOX TESTING

This type of testing ensures that

- All independent paths have been exercised at least once
- All logical decisions have been exercised on their true and false sides
- All loops are executed at their boundaries and within their operational bounds
- All internal data structures have been exercised to assure their validity.

To follow the concept of white box testing we have tested each form .we have created independently to verify that Data flow is correct, All conditions are exercised to check their validity, All loops are executed on their boundaries.

2.BASIC PATH TESTING

Established technique of flow graph with Cyclomatic complexity was used to derive test cases for all the functions. The main steps in deriving test cases were:
Use the design of the code and draw correspondent flow graph.

Determine the Cyclomatic complexity of resultant flow graph, using formula:
V(G)=E-N+2 or
V(G)=P+1 or

V(G)=Number Of Regions

Where V(G) is Cyclomatic complexity,
E is the number of edges,
N is the number of flow graph nodes,
P is the number of predicate nodes.
Determine the basis of set of linearly independent paths.

3. CONDITIONAL TESTING

In this part of the testing each of the conditions were tested to both true and false aspects. And all the resulting paths were tested. So that each path that may be generate on particular condition is traced to uncover any possible errors.

4.DATA FLOW TESTING

This type of testing selects the path of the program according to the location of definition and use of variables. This kind of testing was used only when some local variable were declared. The *definition-use chain* method was used in this type of testing. These were particularly useful in nested statements.

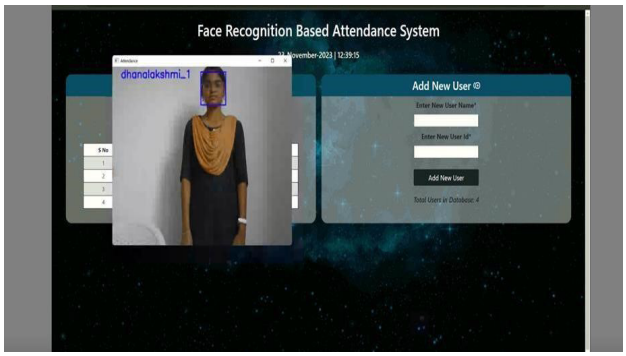
5.LOOP TESTING

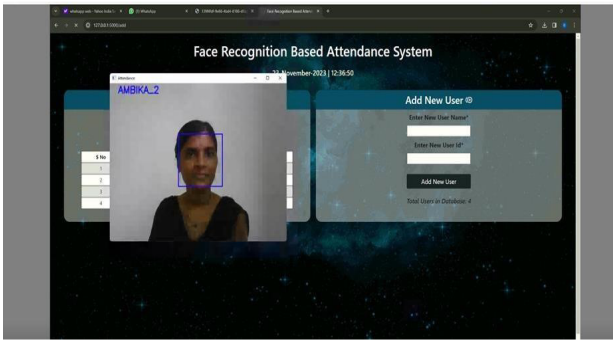
In this type of testing all the loops are tested to all the limits possible. The following exercise was adopted for all loops:

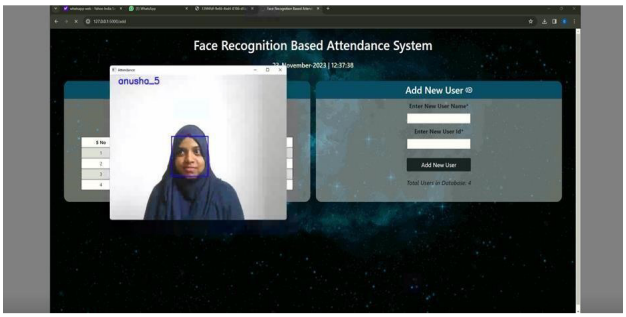
- All the loops were tested at their limits, just above them and just below them.
- All the loops were skipped at least once.
- For nested loops test the inner most loop first and then work outwards.
- For concatenated loops the values of dependent loops were set with the help of connected loop.
- Unstructured loops were resolved into nested loops or concatenated loops and tested as above.

Each unit has been separately tested by the development team itself and all the input have been validated.

VI.SCREENSHOTS







CONCLUSION

The proposed automated student attendance system, based on face recognition and implemented on the Raspberry Pi, is comprehensively explained. This innovative approach effectively identifies and locates faces in input facial images, derived from recorded video frames. Additionally, the system incorporates a pre- processing stage to enhance image contrast and mitigate illumination effects. The extraction of facial features is carried out using advanced face detection and recognition algorithms, considering various lighting conditions. The Raspberry Pi platform plays a crucial role in executing these processes. In conclusion, the system automatically marks student attendance by recognizing their faces, comparing them with the database, and storing the attendance data on the Raspberry Pi, showcasing a robust and efficient solution for attendance management in varying conditions.

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