

Students Emotion Detection when solving Geometrical Problems

Application Requirements Document

project id: 3

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Chapter 1

Introduction

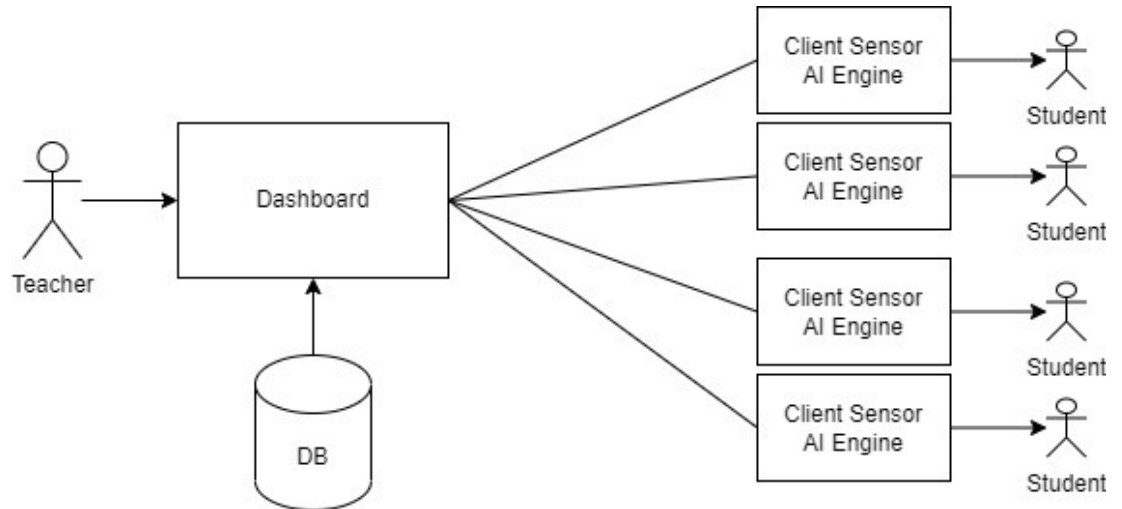
1.1 The Problem Domain

In a class full of Students , it's a major task for the Teacher to keep up on the real-time progress of students, especially those who are having problem understanding or solving problems ,so monitoring their emotions , such as stress ,frustration and relief can really be a good measure to look at.

so, creating a new approach to teaching system that uses facial emotion recognition to help the teacher better grasp the students' circumstances/situation during learning and solving math problems , while seeing each one's state on dashboard that send alerts when one student is having a trouble , each student will have a camera sensor that detects their emotion .

1.2 Context

A Web-Application based system, including Client with AI emotion detection system for every student in the classroom and dashboard for the teacher where he can see the emotions of his students.



1.3 Vision

a brand-new method of instruction that makes use of facial emotion detection to assist the teacher in better understanding the circumstances/situation of the students while they are studying or solving math/geometric problems

1.4 Stakeholders

- teachers
- student

1.5 Software Context

The system is a Server-Client Application, including an AI emotion detection system , A dashboard in MERN web application .

Major inputs:

- student face as stream of frames (real time video)
- teacher:

Functionality & Processing:

client:

- processing the video using AI/ML algorithms to detect the student emotions
- sending the output of the algorithm to the teacher

Output:

server:

- displaying the students emotions on the dashboard
- notify the teacher if some student have a negative emotions

Chapter 2

Usage Scenarios

a. User Profiles — The Actors

Actors are students and teachers.

students: solve geometrical problems and the sensor capture their emotion in real-time.

teachers: monitor students emotions/state on the dashboard .

b. Use-cases

Use Case Name: User Registration

Actors: student/ teacher

Precondition: None

Postcondition: the system save the user data

Flow:

- the user enter the URL link
- the user click registration button
- the system display a form to the user and ask it to fill it with his name + email + password + (teacher/student)
- the student fill the form and click register button
- the system saves the user data

Use Case Name: User sign-in

Actors: student/teacher

Precondition: the user registered to the system

Postcondition: None

Flow:

- the user enter the URL link
- the user click sign-in button
- the system display a form to the user and ask it to fill it with his email + password
- the user fill his email and password and click the sign-in button
- if the credentials is correct: user will log in to the system
- else : proper message will be displayed

Use Case Name: Student positive emotion

Actors: student

Precondition:

- student enter the teacher class/ group
- student's camera is opened

Postcondition:

- teacher dashboard changed to the current state of the student

Flow:

- the camera capture the student face
- the system process the camera input and detect the real-time emotion
- the system sends the real-time emotion to the teacher dashboard
- the dashboard changes to the current student's emotion

Use Case Name: Student negative emotion

Actors: student

Precondition:

- student enter the teacher class/ group
- student's camera is opened

Postcondition: None

Flow:

- the camera capture the student face
- the system process the camera input and detect the real-time emotion
- the system sends the real-time emotion to the teacher dashboard
- the dashboard changes to the current student's emotion
- the dashboard notifies the teacher with a relevant notification.

Use Case Name: filtering for a specific set of emotions

Actors: teacher

Precondition:

- student enter the teacher class/ group
- student's camera is opened
- teacher enter the system

Postcondition: None

Flow:

- the teacher select a set of emotions on his dashboard
- the system filter the all students' emotions and display only the set that the teacher choose

Use Case Name: choose a set of emotions to get notifications on

Actors: teacher

Precondition:

- student enter the teacher class/ group
- student's camera is opened
- teacher enter the system

Postcondition: None

Flow:

- the teacher select a set of emotions on his dashboard that he what the system to notify him on
- the system disable "Student negative emotion" notification
- the system notify the teacher when a student change his emotion to these emotions

Use Case Name: display statistics table for student emotions

Actors: teacher

Precondition:

- student enter the teacher class/ group
- student's camera is opened
- teacher enter the system

Postcondition: None

Flow:

- the teacher Click on a statistic button
- the system display on the dashboard a statistic table with all students emotions during the activity

Use Case Name: Student Click Ask for help button

Actors: student

Precondition:

- teacher lookup at the Student

Postcondition: None

Flow:

- Students Click Ask For help Button
- the system sends the real-time request to the teacher's dashboard
- the dashboard shows the student's name asking for help

c. Special usage considerations

- connection to internet
- camera with all the students computers
- the student solve the questions while looking to the screen

Chapter 3

Functional Requirements

User:

- i. the user must be able to register to the system using email and password.
- ii. the user must be able to choose to be a teacher or student.
- iii. the user must be able to open the system using his email and password.

Teacher:

- iv. the teacher must be able to open a new teaching class/group giving a specific name.
- v. the teacher must be able to enter the group that he opened and start watching the online students' emotions in real-time.
- vi. the teacher must be able to accept/reject students' requests for adding themselves to his group.
- vii. the teacher must be able to ask the system for a specific emotions notification
- viii. the teacher should be able to filter the emotions that he see on the dashboard
- ix. the teacher must be able to see statistics table for his students emotions during the class time ,how much in percent student feel every emotion

student:

- x. the student must be able to see all available classes.
- xi. the student should be able to filter the class using the class/teacher name.
- xii. the student must be able to send a request for the teacher to add him to a class/group.
- xiii. the student should be able to open/close the camera.

Chapter 4

4.1 Implementation constraints

performance:

- The system must display the students emotions in real-time (less than 3 seconds).
- the notification system will be immediately responsive . (up to 500ms)

security:

- The system must not save the users' passwords without encrypting them.
- The system must display students' emotions only to the teacher who created the class/group
- facial captures (real student faces) will not be stored

Portability:

- The system should be a web service and will be tested on Google Chrome and Firefox.
- The system should be accessible from different operating systems.

Usability:

- The system's users do not have any special expertise in computer or programming, therefore the system's interface should be as simple and clear as possible.
- Friendly interface for low age users (students).

Availability:

- The system should be available 24/7

4.2 Platform constraints

For the Detection System we need to use special AI Engine libraries , we chose OpenCV and Python is the programming language that satisfies the need of this library , and for the Dashboard ,real-time notification system we will use the MERN (Mongo,Ecpres,React,nodeJS) to meet our requirements.

4.2.1 SE Project constraints

The system will have :

- user-client interaction : low-age users (students) and teacher will use it)
- client-server interaction : real-time messaging and data flow ,http communication.
- client-with AI engine interaction : the client sensor (camera) will send data to the AI engine in order to analyze the emotion

we need to create a prototype and demo runnable application in order to test the project

4.3 Special restrictions & limitations

The system will have interactions with low-age users (students with ages between 6-12 years) , so clearly we need the confirmation and approval of the parents ,school in order to capture the emotion of their faces and export the data to analysis of the AI Engine .

we will test our project in 2 different schools (from arabian and jewish sectors) in order , so also we need to have the schools manager's approval .

We need laptops with cameras in order to apply our test , also we need a secure environment to test our project because it contains sensitive data about the low age users.

Chapter 5

Risk assessment & Plan for the proof of concept

In the first prototype we are planning to create the system with the basic functionality to get the sense of how the system will look like and to understand which functions are easier to implement and which functions are harder to create. In addition, during the work of the prototype we will be able to discuss with our client

on the system's restrictions.

The basic functionality of the prototype will be to create the main dashboard for the teacher , and test if it can integrate with the AI Engine (OpenCV) and to enable new users to register and to sign in to the class.

In the prototype we will try to build the real-time messaging system to implement the functionality of sending real-time events of emotion detection and exporting data.

This functionality is in high risk assessment and that is why we have include it in the first prototype, in order to understand the risk of the project failure.

In the prototype it will be the first time we are building a real-time messaging web application along with Integrating with the AI.

This means that we will use new technologies and new programming languages, during the

process of creating the prototype we will understand the limitations of those new technologies.

