FaceGuard

Development of a Student Attendance System Based on
Machine Learning Using Computer Vision

MAN 2 JAKARTA

INTRODUCTION

Information and communication technology is being used more and more in many fields, including education. Handling student absences by hand in education presents a number of challenges, including **incomplete or corrupted data, sluggish data entry, and poor data capture**. These issues have the potential to impair student attendance tracking and lower educational standards. FaceGuard technology offers an answer to this problem by enabling automatic, more precise, and efficient absence tracking while also lowering the risk of fraud.
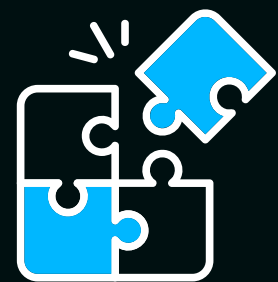
Inaccurate Data

Takes a lot of Time

Unorganized Data
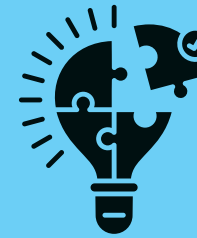
BACKGROUND _

FORMULATION OF PROBLEM _

01

What are the effective solutions to address the shortcomings of manual attendance data collection, such as the possibility of incorrect data entry, missing data, or damaged data?

02

How can attendance records be better organized and stored to facilitate easier tracking and management of student attendance data?

01

To find effective solutions for addressing the shortcomings of manual attendance data collection, such as the possibility of incorrect data entry, missing data, or damaged data.

02

To identify better methods for organizing and storing attendance records to facilitate easier tracking and management of student attendance data.

RESEARCH OBJECTIVE

BENEFITS OF RESEARCH
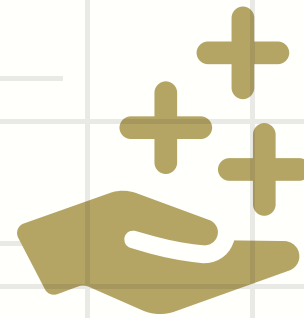
Theoretical Benefits

Practical Benefits

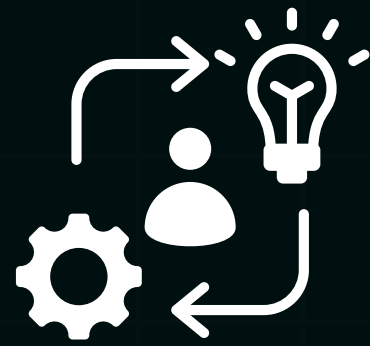**01** Benefits for School Administrators

02 Benefits for Student

03 Benefits for School

METHODOLOGY

RESEARCH & DEVELOPMENT

Creation of FaceGuard, a face recognition-based daily presence system for students in the MAN 2 Jakarta neighborhood. The device's efficacy will next be tested, and the facial recognition algorithm's accuracy will also be tested.
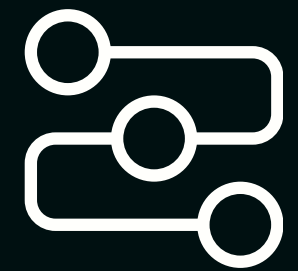
ADDIE DEVELOPMENT MODEL

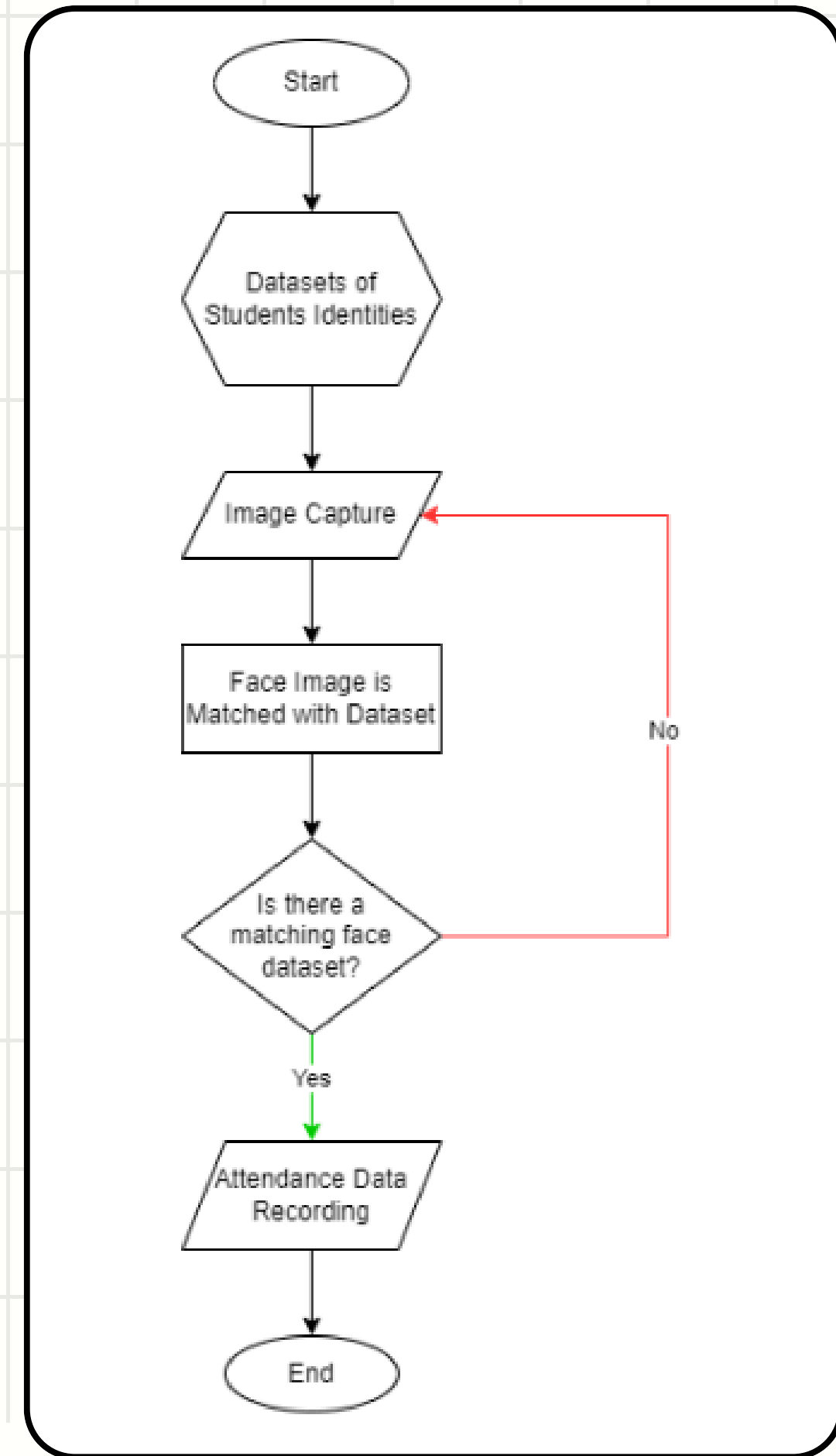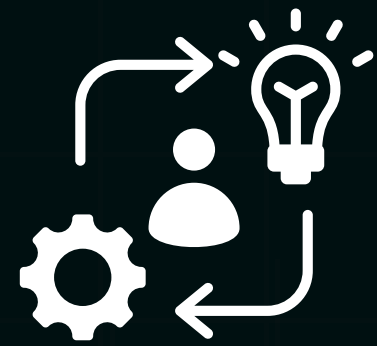The ADDIE development model is based on the stages Analyze, Design, Development, Implementation and Evaluation.
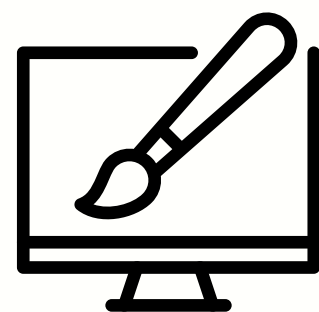
# OVERALL COMPONENT DESIGN
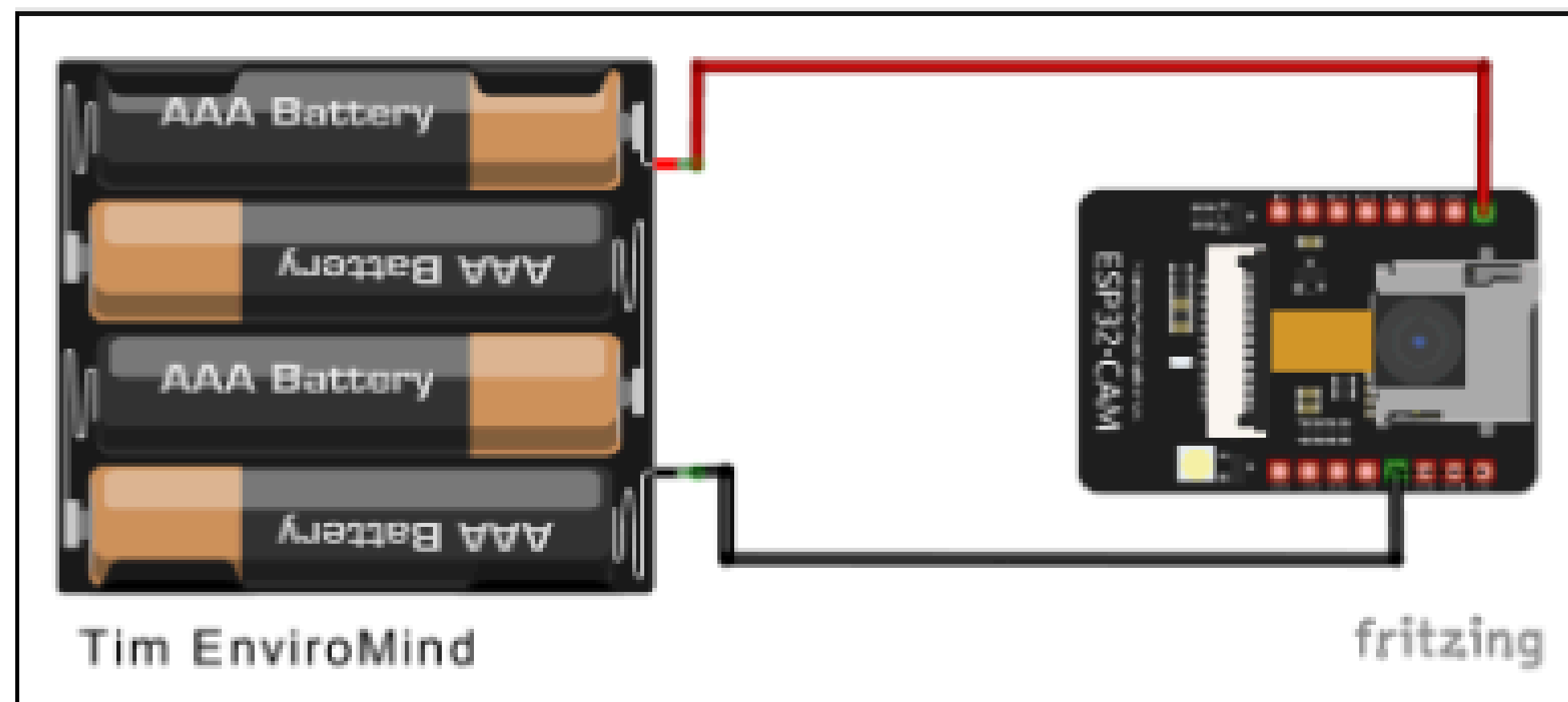
FLOWCHART

FUNCTIONALITY TESTING

TEST CASES

NO	TESTING	TEST CASE	EXPECTED CASE
1	Student Face Detection	Face Detection Successful	The system recognizes the student's face correctly and matches it with the data in the database.
2		Failed Face Detection (Poor Lighting)	The system fails to detect the face or provides a notification that the face was not detected.
3		Failed Face Detection (Face Covered)	The system fails to detect the face or provides a warning that the face is not fully visible.
4		Failed Face Detection (Unknown Face)	The system does not recognize the face and gives a notification that the face is not registered.
5	Student Attendance Data Submission	Successful Data Submission	The attendance data is successfully sent to the server and saved in the database.
6		Failed Data Submission (Disconnected Internet)	The system fails to send the data and gives a notification that the connection is down.
7		Failed Data Submission (Server Down)	The system fails to send the data and gives a notification that the server is inaccessible.
8	Student Attendance Data Website	Successful Website Access	The user successfully logs into the dashboard and can view the attendance data on the system.
9		Failed Website Access (Wrong Credentials)	The system denies access and shows an error: 'Incorrect username or password.'
10		Data Filter Feature Usage	The system displays the attendance data based on the applied filter criteria.
11		Attendance Data Download	The attendance data file is successfully downloaded and contains the data as displayed on the website.
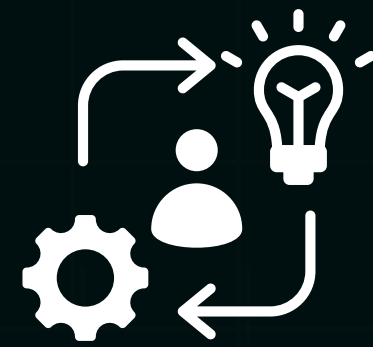
SUS ANALYZE

No.	Questions	Scale
1	I think interested people will use this tool again.	1-5
2	I feel that the tool is difficult to use.	1-5
3	I think that the tool is easy to use.	1-5
4	I feel like I need help from other people or technicians in using this tool.	1-5
5	I feel that the features of the tool work well.	1-5
6	I think there are too many inconsistencies in this tool.	1-5
7	I imagine that most people will find it easy to learn the tool very quickly.	1-5
8	I found the tool complicated to use.	1-5
9	I feel confident in using this system	1-5
10	I need to get used to learning a lot of things before I can enjoy using this tool.	1-5

QUESTIONS
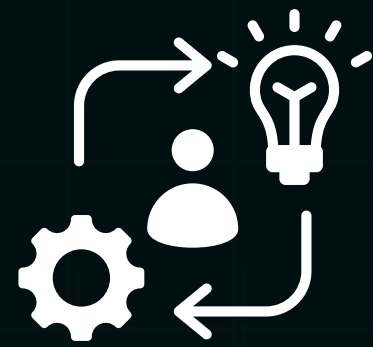
SUS ANALYZE

$$\bar{x} = \frac{\sum x}{n}$$

$\bar{x}$ = Average Score

$\sum x$ = Total SUS Score

n = Total of Respondents

FORMULA
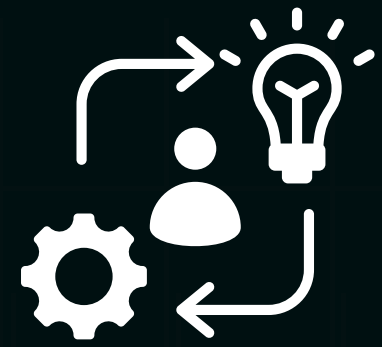
ALGORITHM ACCURACY TESTING

TEST CASES

No.	Test Case	Scenarios
1	TC-01	Identification in a crowd (good lighting)
2	TC-02	Identification in a crowd (poor lighting)
3	TC-03	One-on-one verification (frontal pose)
4	TC-04	One-on-one verification (side pose)
5	TC-05	Identification with appearance changes (glasses)
6	TC-06	Identification with appearance changes (hair)
7	TC-07	Identification of faces in low resolution
8	TC-08	Identification of faces with different expressions
9	TC-09	Identification of faces from various ages
10	TC-10	Identification of faces with complex backgrounds

INTERFACE DESIGN ✦

Front Page

INTERFACE DESIGN

Data Presensi MAN 2 JAKARTA

Filter Data

Pilih Kelas:

XII-A

Pilih Tanggal:

2024/07/26

Print ke XLSX   Print ke PDF

Data Presensi Kelas XII-A pada 2024-07-26

No.	Nama	Kelas	Status	Tanggal	Waktu Presensi
1	ADHINING KARTIKA RENAKSA	XII-A	HADIR	2024-07-26	06:03:52
2	ADIMAS ARIOJATI WISNU PRABOWO	XII-A	HADIR	2024-07-26	06:13:28
3	AHMAD HAMRA	XII-A	HADIR	2024-07-26	06:05:49
4	AL ZETI NADIA OKTAFIANI	XII-A	HADIR	2024-07-26	05:59:37
5	ANANDA RIZKY AMELIA PURBA	XII-A	HADIR	2024-07-26	05:50:57
6	AQILA BAHIRATUL HAKIMAH	XII-A	TERLAMBAT	2024-07-26	06:44:47
7	AULIA PUTRI KHAIRA	XII-A	HADIR	2024-07-26	05:59:23
8	AULIA SYIFA DAMARA	XII-A	HADIR	2024-07-26	05:48:02

Presence Page

FUNCTIONAL TESTING _

| NO	TESTING	TEST CASE	EXPECTED CASE	RESULT
1	Student Face Detection	Face Detection Successful	The system recognizes the student's face correctly and matches it with the data in the database.	VALID
2		Failed Face Detection (Poor Lighting)	The system fails to detect the face or provides a notification that the face was not detected.	VALID
3		Failed Face Detection (Face Covered)	The system fails to detect the face or provides a warning that the face is not fully visible.	VALID
4		Failed Face Detection (Unknown Face)	The system does not recognize the face and gives a notification that the face is not registered.	VALID
5	Student Attendance Data Submission	Successful Data Submission	The attendance data is successfully sent to the server and saved in the database.	VALID
6		Failed Data Submission (Disconnected Internet)	The system fails to send the data and gives a notification that the connection is down.	VALID
7		Failed Data Submission (Server Down)	The system fails to send the data and gives a notification that the server is inaccessible.	VALID
8	Student Attendance Data Website	Successful Website Access	The user successfully logs into the dashboard and can view the attendance data on the system.	VALID
9		Failed Website Access (Wrong Credentials)	The system denies access and shows an error: 'Incorrect username or password.'	VALID
10		Data Filter Feature Usage	The system displays the attendance data based on the applied filter criteria.	VALID
11		Attendance Data Download	The attendance data file is successfully downloaded and contains the data as displayed on the website.	VALID
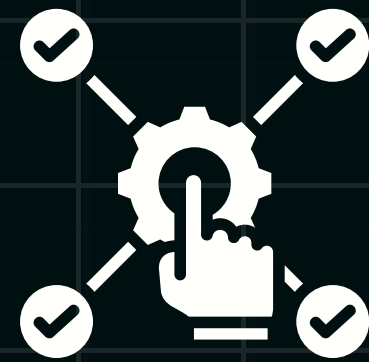
USABILITY TESTING

No	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS Score
R1	5	1	5	2	5	1	5	1	5	3	92.5
R2	5	1	5	2	5	1	5	1	5	3	92.5
R3	5	1	5	3	5	2	5	1	5	3	87.5
R4	5	1	5	3	5	1	5	1	5	5	85
R5	5	1	5	1	5	1	5	1	5	1	100
R6	5	1	5	3	5	2	5	1	5	3	87.5
R7	5	1	5	3	5	1	5	1	5	2	92.5
R8	5	1	5	2	5	1	5	1	5	5	87.5
R9	5	1	5	2	5	1	4	1	2	3	82.5
R10	4	1	5	3	5	2	4	1	5	3	82.5
R11	5	1	5	5	5	1	5	1	5	1	90
R12	5	1	5	2	5	1	4	1	4	5	82.5
R13	5	2	4	2	5	1	5	1	5	5	82.5
R14	5	1	2	5	2	4	2	4	2		85
R15	5	1	5	3	5	2	5	2	5	2	87.5
R16	4	1	5	2	5	2	4	2	4	1	85
R17	3	1	4	2	4	3	5	1	5	1	82.5
R18	5	1	5	2	5	1	5	1	5	1	97.5
R19	5	2	5	1	5	2	3	1	5	5	80
R20	5	2	5	1	5	1	5	2	5	2	92.5
R21	5	2	5	2	5	1	5	2	5	2	90
R22	5	2	5	2	4	2	5	2	5	4	80
R23	4	2	5	1	4	2	5	2	4	1	85
R24	5	2	5	1	4	1	4	1	4	4	82.5
R25	5	2	5	2	4	2	4	1	4	1	85
R26	5	1	5	2	4	2	4	2	5	2	85
R27	5	2	5	1	4	1	4	1	3	2	85
R28	4	1	5	2	5	3	5	1	4	4	80
R29	5	1	4	2	5	2	5	2	5	1	90
R30	5	2	5	2	5	1	4	2	5	1	90
R31	4	2	4	1	5	1	5	2	4	2	85
R32	4	1	5	2	5	2	5	1	4	1	90
R33	5	1	5	2	5	2	4	2	5	1	90
R34	5	3	4	3	4	2	5	1	5	2	80
R35	4	2	5	2	5	2	4	2	4	1	82.5
R36	5	2	5	3	5	2	5	1	5	3	85
R37	5	1	5	2	5	1	5	1	5	2	95
R38	4	2	4	1	4	1	5	2	5	2	85
R39	4	2	5	3	5	2	5	1	4	2	82.5
R40	5	1	4	1	5	1	4	2	4	1	90

This test was conducted by 40 respondents, including students, teachers, and educational staff. Before the respondents evaluated the tool, they first tried out the FaceGuard device.

The total SUS score of all respondents was **3472.5**. Then divided by 40 respondents to obtain an average SUS score of **86.56**.
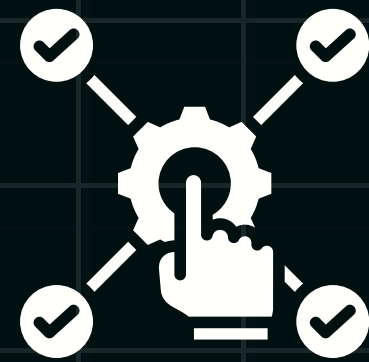
USABILITY TESTING

Based on the Acceptability Range level, it is included in the **Acceptable Category**.

Then, based on the Grade Scale, the VoteSphere selection tool is included in the **A+** category. Based on Adjective Ratings, it is included in the **Excellent Category**.

Letter Grade	Numerical Score Grade
A+	**84.1-100**
A	80.8-84.0
A-	78.9-80.7
B+	77.2-78.8
B	74.1-77.1
B-	72.6-74.0
C+	71.1-72.5
C	65.0-71.0
C-	62.7-64.9
D	51.7-62.6
F	0-51.6

| No.	Test Case	Scenarios	Total Images	Successful Images	Accuracy Percentage (%)
1	TC-01	Identification in a crowd (good lighting)	50	45	90
2	TC-02	Identification in a crowd (poor lighting)	50	35	70
3	TC-03	One-on-one verification (frontal pose)	30	28	93.3
4	TC-04	One-on-one verification (side pose)	30	25	83.3
5	TC-05	Identification with appearance changes (glasses)	20	16	80
6	TC-06	Identification with appearance changes (hair)	20	18	90
7	TC-07	Identification of faces in low resolution	40	30	75
8	TC-08	Identification of faces with different expressions	40	35	87.5
9	TC-09	Identification of faces from various ages	50	45	90
10	TC-10	Identification of faces with complex backgrounds	50	42	84
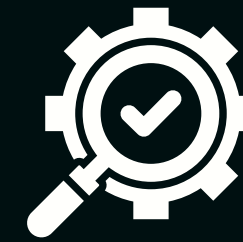
ALGORITHM ACCURACY .- TESTING
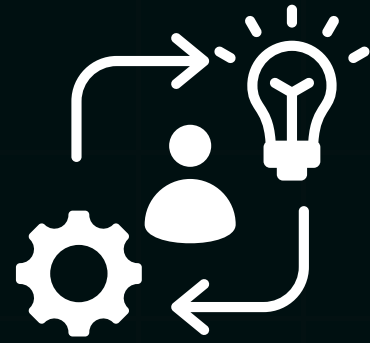
CONCLUSION

The FaceGuard system was successfully implemented and performed well in various scenarios, including different lighting, obstacles, and poses. While internet and server issues occasionally caused data transmission failures, the system provides notifications for these problems. Usability testing with 40 respondents, including students, teachers, and staff, showed an excellent System Usability Scale (SUS) score of 86.56, confirming its ease of use and reliability for school attendance management. The facial recognition algorithm demonstrated strong performance with an average accuracy of 83.82% in challenging conditions.
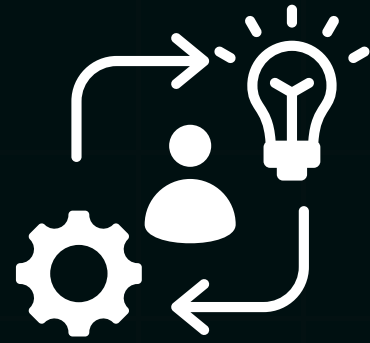
SUGGESTIONS

It is recommended to improve the face detection algorithm so that it can operate more optimally in poor lighting conditions and when the face is partially covered.

It is recommended to provide education and training to teachers and students regarding the use of this attendance system, so that the system can be used optimally without technical obstacles in the field.

It is recommended to add an automatic notification feature for student parents when students are absent, as well as stronger data security features to maintain the privacy of student biometric data.

It is hoped that this research can expand its application not only in school environments, but also in other agencies or institutions that require an automatic attendance system based on Face Recognition technology.

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KEMENTERIAN HUKUM DAN HAK ASASI MANUSIA

SURAT PENCATATAN CIPTAAN

Dalam rangka pelindungan ciptaan di bidang ilmu pengetahuan, seni dan sastra berdasarkan Undang-Undang Nomor 28 Tahun 2014 tentang Hak Cipta, dengan ini menerangkan:

Nomor dan tanggal permohonan : EC00202490992, 26 Agustus 2024

Pencipta
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Kewarganegaraan : Indonesia

Pemegang Hak Cipta
Nama : **Ahmad Hamra**
Alamat : Jl. Sabeni II, No. 11, RT. 013/RW. 002, Kalisari, Ps. Rebo, Jakarta Timur, DKI Jakarta, 13790., Pasar Rebo, Jakarta Timur, Dki Jakarta 13790
Kewarganegaraan : Indonesia
Jenis Ciptaan : **Karya Ilmiah**
Judul Ciptaan : **FaceGuard: Pengembangan Alat Presensi Kehadiran Siswa Berbasis Machine Learning Menggunakan Computer Vision**
Tanggal dan tempat diumumkan untuk pertama kali di wilayah Indonesia atau di luar wilayah Indonesia : 25 Agustus 2024, di Jakarta Timur
Jangka waktu pelindungan : Berlaku selama hidup Pencipta dan terus berlangsung selama 70 (tujuh puluh) tahun setelah Pencipta meninggal dunia, terhitung mulai tanggal 1 Januari tahun berikutnya.
Nomor pencatatan : 000666310

adalah benar berdasarkan keterangan yang diberikan oleh Pemohon.
Surat Pencatatan Hak Cipta atau produk Hak terkait ini sesuai dengan Pasal 72 Undang-Undang Nomor 28 Tahun 2014 tentang Hak Cipta.

a.n. MENTERI HUKUM DAN HAK ASASI MANUSIA
DIREKTUR JENDERAL KEKAYAAN INTELEKTUAL
u.b
Direktur Hak Cipta dan Desain Industri

IGNATIUS M.T. SILALAHI
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Thank You

Presentation by Team FaceGuard