STUDENT MONITORING SYSTEM AT SDIT IBNU KHALDUN FOR SHUTTLE CAR USING GPS TECHNOLOGY AND WEBCAMS BASED RASPBERRY PI

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ABSTRACT

IOT (Internet of Thing) is a technology that is being much loved because it could increase the efficiency of a job. IOT is itself a concept where an object has the ability to perform the delivery of the information or data without the need of a human with a human or a human with a computer. Implementation of IOT is meant to build a shuttle car monitoring system in order to make it easier for teachers and parents in monitoring the position of the students SDIT Ibnu Khaldun and also know the students of SDIT Ibnu Khaldun in the car shuttle.

To resolve the issue would be designed System Monitoring students SDIT Ibnu Khaldun on a shuttle car using GPS and Webcam based Raspberry Pi. The system can present a shuttle car location information and also information the students in a car Shuttle, so teachers and parents know the position of the students and also know the students of SDIT Ibnu Khaldun in the car shuttle

Based on the results of testing blackbox and beta has been done then it can be inferred that functionally the entire process on the system monitoring students SDIT Ibnu Khaldun on a shuttle car using GPS and Webcam based Raspberry pi is in compliance with the expected and can help teachers and parents also monitoring students in the SDIT Ibnu Khaldun.

Keywords: Raspberry pi, monitoring, Iot, mikrokontroler

1. PRELIMINARY

SDIT (Integrated Islamic primary school) Ibnu Khaldun is one private primary school which combines public education and religious education becomes a tangle of curriculum, SDIT is located in Jl. Buniasih Ds. Langensari Kec. Lembang Kab. West Bandung. SDIT Ibnu Khaldun has 335 students male 312 female students and teachers have as many as 19 people. SDIT Ibnu Khaldun is one school that is implementing a system of full day school. SDIT Ibnu Khaldun provides a shuttle car to facilitate parents in dropping off her son's, most SDIT students Ibnu Khaldun rely on a shuttle car facilities as a means of daily transport to school.

Based on the results of interviews with Rini Mirawati, S.Pd.I as a staff TU/Treasurer and also teachers in the SDIT Ibnu Khaldun he found constraints on car shuttle system school SDIT Ibnu Khaldun, he often asked by parents the students when the Cubs haven't been to the House, and there are teachers not able to ascertain the position of his disciples still where. One of the things that am afraid by teachers and parents are also in case of unwanted things, such as child abduction cases and crimes against children. SDIT Ibnu Khaldun teachers during this time can only ascertain the State of his son through SMS and phone calls to driver a car shuttle. It is considered less effective because the teacher must contact the pick-up driver via SMS or phone sometimes drivers do not directly respond to SMS and also sometimes difficult to be reached when the call due to being away.

SDIT Ibnu Khaldun also have other constraints, such as problems that are often experienced a shuttle car is often down students are not in place, consequently parents often ask the existence of his son to the teacher.

In general monitoring system is a system that applied to monitoring and safeguards so that teachers and parents can see whether a students of SDIT Ibnu Khaldun survived until the goal so that when there is a problem could be quickly resolved. By utilizing Raspberry Pi will then made applications to monitor students SDIT Ibnu Khaldun in the car with the Webcam and also the location of the car using a GPS Module, then automatically uploaded periodically into the Webserver and the result can be viewed using the website.

The purpose of this research is to build a monitoring system that teachers and parents can find out the position of shuttle cars accurately and a State pupil SDIT Ibnu Khaldun in the car quickly exploit using the concept of the IOT.

2. Basis Theory

2.1. Raspberry Pi

Raspberry Pi is an SBC (SingleBoard Computer) using the system on a chip (SoC) from Broadcomm BCM2835, also includes processor 700 MHz ARM1176JZF-S, Video GPU Core IV and 256 MB of RAM (Rev. A) and 512 MB (for Rev. B) [3].

Raspberry Pi has a size that is not too bersar think only about the size of a ATM card. Raspberry Pi is a computer, then in the same function with a computer we have [4]. That is, the Raspberry Pi can be used to create documents, calculate, draw, browse the internet, download, print documents, watch films, play music, play games, and more. Raspberry Pi has a size small, therefore Raspberry pi is very practical to carry everywhere and the price is relatively cheaper than on a computer or laptop that we have.

Raspberry Pi does not require electricity to operate. We could appeal the power to the computer at home which requires electrical power ranging from 200 watts [4]. Raspberry Pi requires little power because it can be ignited only with mobile phone charger. Raspberry Pi developed by Raspberry Pi Foundation. The idea of making Raspberry pi arose when a group of students from the University of Cambridge, Yakni Eben Upton, Rob Mullins, Jack Lang, and Alan Mycroft. Initially the Raspberry Pi is used to help the people in Africa to learn computers with very cheap prices. So people and schools that do not have enough funds to buy a perosnal computers could switch to Raspberry Pi as an alternative. The Raspberry Pi do many innovations so as to attract much attention besides the ability of Raspberry pi is also very reliable.

The main advantage of the Raspberry Pi is located from the pins that can program to help our work, pin-this pin can be in a program to collect data or control things surrounding us.

Raspberry Pi has a very large community support that can help and inspire us in making project.

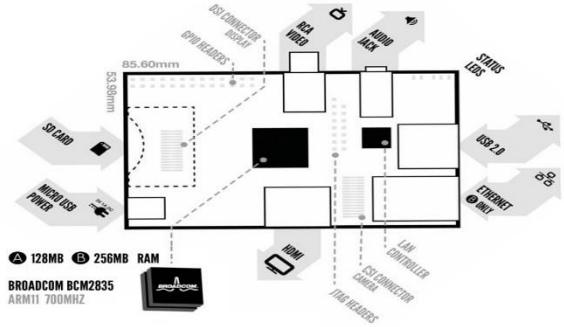


Figure 1. Raspberry component model A and model Pi B

2.2 Webcam

The webcam is a combination of the words web and camera. Own appellation for webcam real-time camera [5], the Webcam is commonly used for applications that require the image to interact such as skype, Yahoo Messenger and others. The webcam itself is usually used for means of long-distance communication using the website, the current webcam also many used for remote monitoring system.

How to work a webcam is by taking the data in the form of images in real-time and display them to the monitor screen or to the website, the use of a webcam by yourself can be set according to the needs of ordinary webcam users we set transmit data within a a certain time or can take pictures continuously. Types of webcams including

1. USB Webcam

   Webcams of this type that we usually use plug and play technology so we can directly use it
2. Network And Wireless Camera

   Network Camera is normally used for the needs of this Webcam security system can be directly connected to the network via modem.

2.3 Module GPS ublox Neo-6M

On this research Module the Neo-6 m uBlox GPS is used to determine the location of the car because the GPS module offers good accuracy that is 0.1 m/s, this module serves as a GPS signal from the receiver to satellite latitude longitude location later in the This module can be sent to the website.

This GPS power requires only a description, 3-5Volt, GPS is commonly used in the arduino, raspberry pi, and others. This GPS module, measuring 25 x 25 x 25 mm and 35 mm for the module, the speed of renewal data up to 5 Hz and has a speed of 500 meters/second (1800km/h).

2.4 Face Recognition

Face recognition or Face Recognition is a task that is already common in everyday life today for example in a crowd we find faces that we know it's a little example of face recognition. Face Recognition usually determines the point is used as the marker between the distance from the eyes, ears, mouth, and nose.

The weakness of the system face recognition is a system often determine an accurate marker point, face recognition is a science which was developed by the computer vision. The system of Face recognition usually begins with taking a picture of the face after it conducted the process of scaling, normalization, and the process grayscaling after all that and then calculated the value of the face. After datatersimpan in the database then the computer can detect the face later became an information.

2.5 Stages Of The Calculation Of The Eigenface

Stages of the process of the calculation of the Eigenface as follows:

1. The first step is setting up the data by creating a set S consists of the entire training image ($\Gamma 1, \Gamma 2, \ldots, \Gamma M$) $S = (\Gamma 1, \Gamma 2, \ldots, \Gamma M)$
2. The second step is to take the middle value or mean (Ψ)

$$\Psi = \frac{1}{M}\sum_{n=1}^{M} \Gamma n \quad M = \text{The Number Of Image}$$

3. Step three then find the difference (Φ) among the training image (Γi) with the value of the Middle (Ψ)

$$(\Phi)i = \Gamma i - \Psi$$

4. The fourth step is to calculate the value of the matrix kovarian (C)

$$C = \frac{1}{M}\sum_{n=1}^{M} (\Phi_n \Phi^T{}_n = AA^T)$$

$$A = \{\Phi_1, \Phi_2, \Phi_3\}$$

$$L = A^T A$$

5. The fifth step is to calculate the eign value(λ) and eigenvector (v) from matriks kovarian (C)

$$C \times Vi = \lambda i \times vi$$

6. Sixth Step, after the eigenvector (v) retrieved, then the eigenface (μ) can be searched by:

$$\mu = \sum_{k=1}^{M} vik\ \Phi_k$$

3. The Design Of The System

3.1 Design Of Prototype

The design prototype is the design of the simulation should be, this is a design prototype that aims so that the functions of this study can be proved, any prototype design explains details the function of the device used. This prototype design will focus on the design of the prototype image delivery and also the design of the location of the car.

1. The design of the prototype Shuttle Car Monitoring System

The design of the photo in the car is done by taking a picture done by camera webcam connected to raspberry pi and sent to the webserver



Figure 2. The design of Monitoring System

3.2 Implementation Of Interface

Interface implementations are done in accordance with the page program that was built with the code in the form of Program files. In the implementation of this interface describes the look of the implementation monitoring system on a shuttle car at SDIT Ibnu Khaldun.

1. LoginLogin Interface Implementation

The following implementations of the interface on the login page in Figure 3



Figure 3. Interface Login

2. Implementation Of Interface Parent

Following the implementation of interfaces in Add Parents in Figure 4.

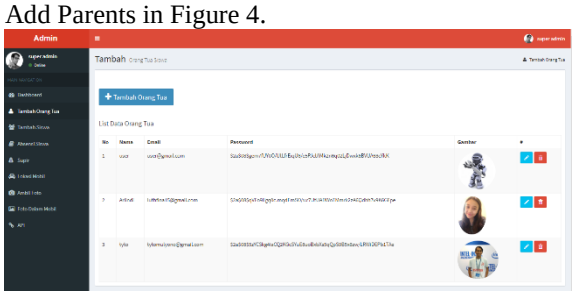
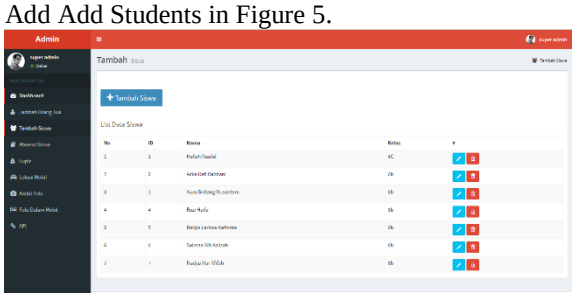


Figure 4. Interface Parent

3. Implementation Of Interface Add Students

Following the implementation of interfaces in Add Add Students in Figure 5.



Siswa Figure 5. Interface Add Students

4. Students Absences Interface Implementation

Following the implementation of Students Attendance on the interface in Figure 6.

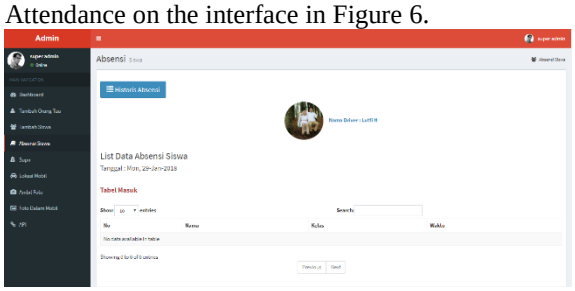


Figure 6. Students Attendance Interface

5. Implementation Of Interface Driver

The following implementations of interfaces on Driver in Figure 7.

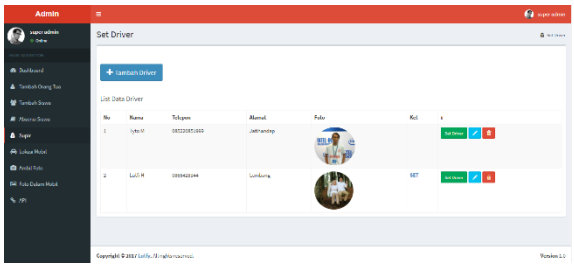


Figure 7. Interface Driver

6. Car Location Interface Implementation

Following the implementation of an interface on a Car's location on Figure 8.

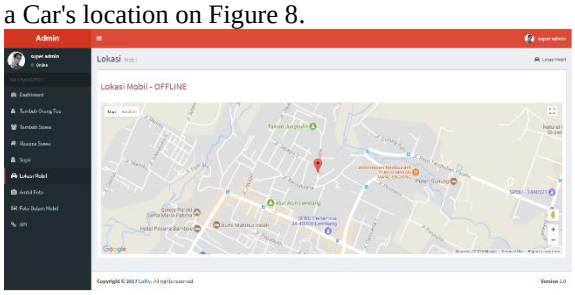


Figure 8. Car Location Interface

7. Car Images In The Interface Implementation

Following the implementation of an interface on a Photo in a car in Figure 9.



Figure 9. Car Images In The Interface

8. Student Data Input Interface Implementation

The following implementations of the interface data input pupil in Figure 10

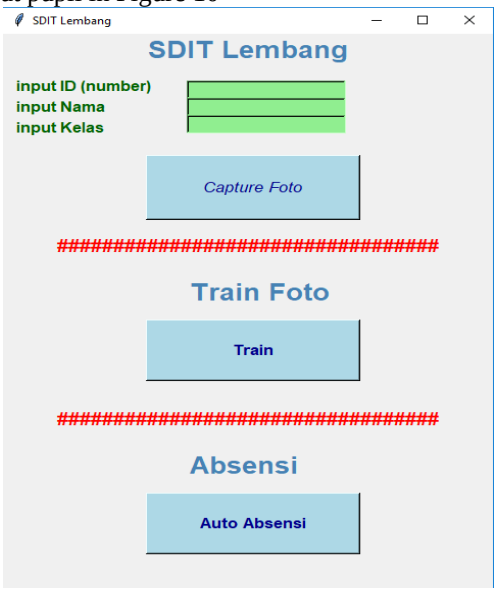


Figure 10. Student Data Input interface

3.3 Sistem Analysis Of Architecture Design System

In this analysis will be given step-by-step how the system will be designed, to clarify about the architectural design of then can be seen.

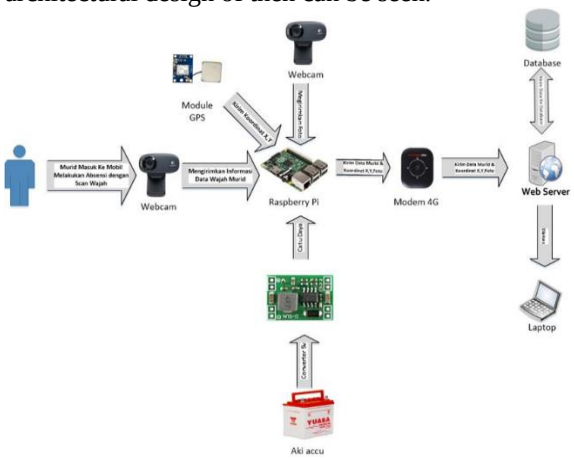


Figure 11. Design Of System Architecture

First of all the webcam and GPS module sends the data via pi raspberry, Webcam mengcapture on duty to face students who enter and submit information to the website face and go straight to the list of attendance. The GPS module is in charge to transmit the coordinates (longitude, latitude) and then will be shown on the website was where the car position. After the Data is processed by the modem will transmit data to the website.

3.4 Hardware Analysis

Needs analysis of the hardware needed to fulfill the application to be run can be seen in table 1.

Table 1. Hardware Requirements Specification

No	Hardware	Type
1	Mikrokontroler	Raspberry Pi 3
2	Camera Web	Logitech C170
3	Micro SD	Sandisk Class10
4	Aki	Yuasa
5	Cable USB	USB 2.0
6	Module GPS	Module GPS neo 6M

Whereas the minimum specifications to run the monitoring system can be seen in table 2.

Table 2. Minimum Specifications

No	Hardware	Specifications
1	Operating System	Windows 7
2	Processor	Core 2 Duo
3	RAM	1GB
4	Disk Space	2GB

While the specs are already supplied users i.e. can be seen in table 3.

Table 3. Specifications That Are Owned

No	Hardware	Specifications
1	Operating System	Windows 10.
2	Processor	Intel Core i5
3	RAM	4 GB
4	Memory Internal	500 GB

After the evaluation about the hardware specs that the hardware it needs have been met.

3.5 Scheme Relation

The partnership scheme is a series of relationships between two or more tables in a database system. Explanation of a series of database on this system dapatdilihat on images below.

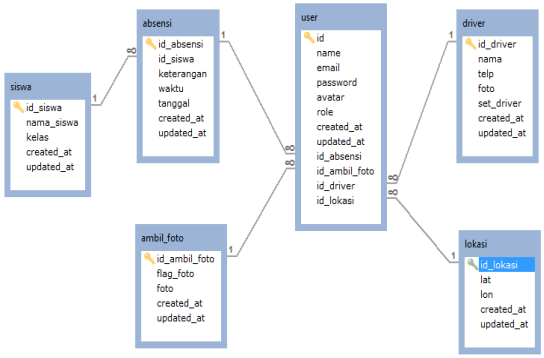


Figure 12. Scheme Relation

3.6 Needs Analysis Software

The software used in the development of this system is as a medium for programming the hardware so that the hardware can run monitoring system in accordance with the work system will be built, can be seen in table 4.

Table 4. Needs Analysis Software

Software	Usability
Python Shell	As a software programming in raspberry pi
Sublime Text	As software to create programs, advantages of Sublime Text is a good user interface and the selection of a folder that is in the design of programming for websites.
MYSQL	Sebagai Database

3.7 Use Case Diagram

Use case diagram is a diagram that shows the functionality of a system or class and how the system interacts with the outside world and explains the system is functionally a sighted user. From the identification of the actors involved in the above then Use Case Diagrams can be seen in Figure.

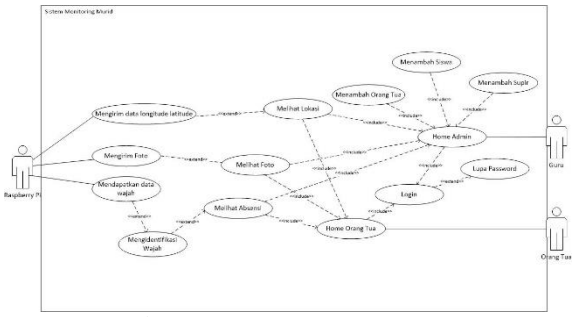


Figure 13. Use Case Diagram

3.8 Class Diagram

Class diagrams is a structural diagram of the model a set of classes, interfaces, collaboration and their colleagues. The class diagram is shown with a box which is basically divided into three sections, namely: class name, attributes, and operations.

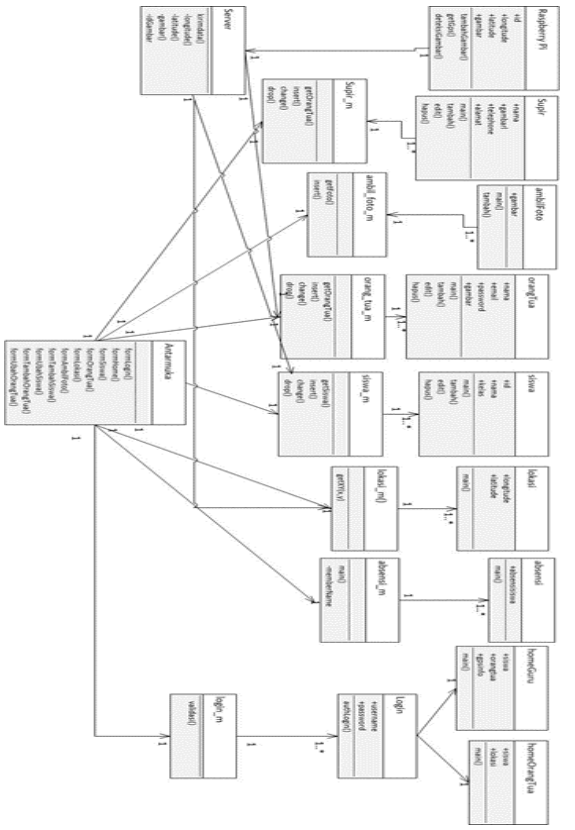


Figure 14. Class Diagram

3.9 The Hardware Implementation

The hardware specifications used in hardware Raspberry Pi exists on table 5.

Table 5. Hardware Specifications

Hardware	Specifications	QTY
Mikrokontroler	Raspberry Pi 3	1 piece
Kamera Web	Logitech C170	1 piece
Modul GPS	GPS Module Neo 6MV2	1 piece
Micro SD	Sandisk Class 10	1 piece

Converter	3A Mini LM2596 DC Step-down Buck Module 5V Step Down MP1584EN	1 piece
Switch	Switch On/off	1 piece
USB Cable	USB 2.0	1 piece
Box	Box no 8	1 piece
Jumper Cable	Female-Female& Male-Male	1 piece
Aki Accu	GS Battery	1 piece

4. System Analysis

Construction of monitoring system of students SDIT Ibnu Khaldun is the system to be built in the school of Ibnu Khaldun SDIT, the monitoring includes monitoring the car's location, disciple who was in the car and in the car. This monitoring system will be carried out by means of utilizing raspberry pi, GPS module, and a webcam. With the construction of the system of teacher and landowner people need not be anxious and worry about the position of shuttle cars still are where, whether students have already come down from the car and also ascertain the circumstances in the car simply by opening the website.

In the development of this system there are several conditions that must be met, either by the user or the user's technical website is divided into two levels, namely the user with admin level and also by level of parents. Admin level users can add parent, add students, absent students, and also the location of the car. For user-level parent page that can be accessed will be restricted, parents only can see the attendance of students, location and photos of the car in the car. The following analysis of the existing systems in the car monitoring system SDIT Ibnu Khaldun:

1. The camera took the picture (image capturing) can be made directly (real time) using the webcam.
2. Image that is already taken by a webcam in preprocessing that aims to remove the parts that are not needed on the image. The stages are done by preprocessing image is grayscale and scaling.
3. After preprocessing is the next process in the nomalisasi process of normalization is to reduce the resolution of the image that is useful for improving the accuracy of the size of the image, the face also equated.
4. After the preprocessing process thereafter is in nomalisasi process of normalization is to reduce the resolution of the image that is useful for improving the accuracy of the size of the image, the face also likened.
5. Eigen value obtained after further matching process is conducted face-to-face by finding the value of a database with the eigenface face to for the most approaching eigen value.

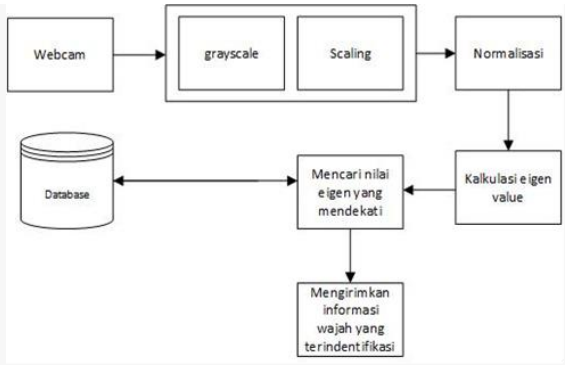


Figure 15. Face Recognition System Architecture

6. The faces that are already identified in the process by raspberry pi and then sent to the website and log in to the attendance of students.
7. The GPS module is useful for determining the position of the car in order to get on the monitor by the teacher and also by parents.
8. The webcam also served to take pictures in a car to the website.
9. The website receives and process data that has been sent by the modem after that data processed and stored in the database.
10. Teachers and parents can view students absences, absences students who came out, the location of cars, driver information, and also the State of the students in the car.

4.1 Analysis Of System Running

Analysis of a system that is running on the SDIT Ibnu Khaldun is the parents register her child to the teacher to transfer by car pickup after that when children have not been to the home of a parent report to a teacher and then a teacher calling or texting to car drivers Shuttle inquire position or condition of the students.

1. Parents enroll her son so that later are picked up by a car pick-up.
2. Teachers Record students who sign up to ride a shuttle car.
3. If already registered with each departing and always came home from school in a car by the shuttle pick-up.
4. If the child had not yet reached the House the parents call the teacher.
5. After hearing the reports from parents, teachers sms or calling the driver asks the child's position and circumstances of his son.

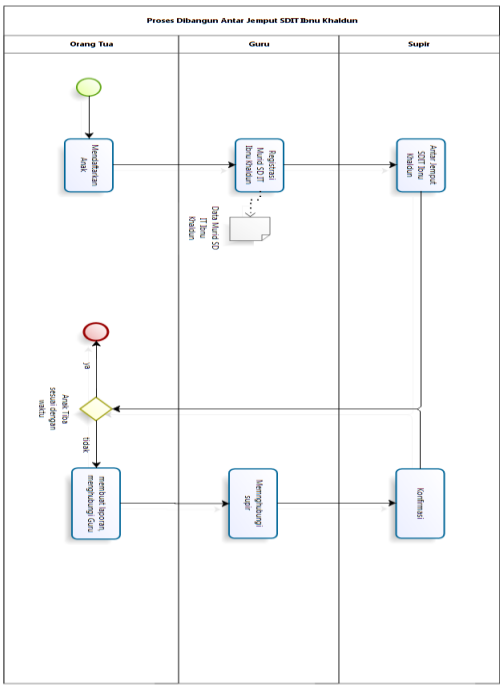


Figure 16. The process of Shuttle students SDIT Ibnu Khaldun

4.2Analysis Process GrayScaling

Graysacaling process is a process in which the colored image is converted to grayscale, suppose one of the facial image has value.

(x.y)	1	2	3
1	(240,240, 240)	(240,240, 240)	(240,240, 240)
2	(255,255, 255)	(255,255, 255)	(255,255, 255)
3	(255,255, 255)	(255,255, 255)	(255,255, 255)

Table 6. RGB values of an image

Here is the calculation to get the grayscale:
I = (R x 0.30) + (G x 0.59) + (B x 0.11)
I = grayscale pixel values
R = the value of the pixels Red
G = the value of the pixel Green
B = Blue pixel values
Perhitungan nilai grayscale dari nilai RGB di tabel 6
I = (240 x 0.30) + (240 x 0.59) + (240x 0.11)
I = (240 x 0.30) + (240 x 0.59) + (240 x 0.11)
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I = (255 x 0.30) + (255 x 0.59) + (255 x 0.11)

The result of the calculation can be seen in table 7.

(x,y)	1	2	3
1	240	240	240
2	255	255	255
3	255	255	255

Table 7. The Results Of Calculations Looking For Grayscale Values

The following is an example of imagery result grayscaling:



Figure 17. Gamabr from RGB to Grayscale

4.3 Analysis Of The Process Of Scaling

The process of scaling is the process of changing the size of a digital image, the method used at the stage of this scaling method using interpolation, by calculating the average of the pixels to represent from the pixels.



Figure 18. Input Before Scaling

Illustration of the value of input for Scaling

(x,y)	1	2	3	4	5	6
1	240	240	240	240	240	240
2	240	240	240	240	240	240
3	255	255	255	255	255	255
4	255	255	255	255	255	255
5	255	255	255	255	255	255
6	255	255	255	255	255	255

Table 8. Illustration of the value of input for scaling

Calculate the value of the pixels in the scaling method using interpolation in the show on in the table 9 below

Koordinat Baru	**Nilai Piksel Citra Asli**	**Nilai Piksel Citra Interpolasi**
(1,1)	(240+240+240+240) / 4	240
(2,1)	(240+240+240+240) / 4	240
(3,1)	(240+240+240+240) / 4	240
(1,2)	(255+255+255+255) / 4	255

Koordinat Baru	Nilai Piksel Citra Asli	Nilai Piksel Citra Interpolasi
(2,2)	(255+255+255+255) / 4	255
(3,2)	255+255+255+255) / 4	255
(1,3)	255+255+255+255) / 4	255
(2,3)	255+255+255+255) / 4	255
(3,3)	255+255+255+255) / 4	255

Table 9. Illustration of the value of the Pixel interpolation results

Resulting value of pixels in table 10 are already on interpolation as follows.

(x,y)	1	2	3
1	240	240	240
2	255	255	255
3	255	255	255

Table 10. The result of the Interpolation

Hasil dari scaling gambar masukan dengan ukuran piksel 100x133 menjadi 50x50 dapat dilihat pada Gambar di 19

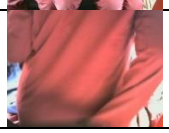


Figure 19. Image scaling results

4.4 Test Photos in cars

Testing photos in the car is a very important part because if teachers and parents want to know the condition of the children in the car of teachers and parents can view photos of students SDIT Ibnu Khaldun periodically every 5 minutes.

Table 11. Testing Take Photo

Take Photo	The expected	Photos Taken	Conclusion
Experiment 1	Take pictures and send photos		[√] Successfully [ ] Rejected
Experiment 2	Take pictures and send photos		[√] Successfully [ ] Rejected
Experiment 3	Take pictures and send photos		[√] Successfully [ ] Rejected
Experiment 4	Take pictures and send photos		[√] Successfully [ ] Rejected
Experiment 5	Take pictures and send photos		[√] Successfully [ ] Rejected

In the experiment Took a picture of the 5-time experiment all the pictures taken and successfully sent to the server successfully or in percentages of success 100%, as for shipment in less than 1 minute.

4.5 Testing Car Location

On testing the car's location is a very important part because that parents and teachers know the poisisi the car accurately, this testing is prepared in 5 different locations.

Table 12. The Test Car's Location

Car Location	Longitude, latitude resulting	Conclusion
Di SDIT Ibnu Khaldun	-6.827019, 107.638467 (SDIT Ibnu Khaldun)	[√] Successfully [ ] Rejected
Jl. Raya Maribaya	-6.818442, 107.631832 (Jl. Raya Maribaya)	[√] Successfully [ ] Rejected
Jl. Panorama	-6.816305, 107.622586 (Jl. Panorama)	[[√] Successfully [ ] Rejected
Jl. Pasir Ipis	-6.817120, 107.621518 (Jl. Pasir Ipis)	[√] Successfully [ ] Rejected
Jl. Grand Hotrl	-6.815176, 107.614796 (Jl. Grand Hotel)	[√] Successfully [ ] Rejected

On the test can be proved that the tool can perform the delivery data, latitude Longitude in either in a car but there is a shift of a few meters from the expected location

5. Conclusion

5.1 Conclusion

1. Based on the analysis of the design and testing of research that has been conducted, the results of data retrieval for a shuttle car location SDIT Ibnu Khaldun fit is very high level of about 90% of this is indicated by the presence of data on longitude and latitude produced just shifted a few metres from the expected location that is -6.826585, 107.638621 to 6.827019, 107.638467-so that these applications can already apply to SDIT school Ibnu Kholdun.
2. Based on the analysis of the design and testing of research that has been conducted, the results of face recognition generated by Raspberry Pi has the accuracy of about 80%, and the level of accuracy of the delivery of images to the server 100% success rate with regard to his delay is less than 1 minute so that these applications can already apply to SDIT school Ibnu Khaldun

5.2 Advice

Suggestions for the development of application system of monitoring students SDIT Ibnu Khaldun in the car pick up a more improved accuracy of face recognition systems, to be more accurate in detecting objects, and should also be developed from the hardware used so that their performance is better.

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