

IoT-based Stunting Education and Early Detection System for Stunting-Free Indonesia

Listiarini Edy Sudiati^{1*}, Wahyu Aditama², Daniel Alfa Puryono³
College of Informatics and Computer Management AKI Pati
Corresponding Author: Listiarini Edy Sudiati listiarini@gmail.com

ARTICLE INFO

Keywords: Stunting, IoT, Waterfall

Received : 08, October

Revised : 15, November

Accepted: 20, December

©2023 Sudiati, Aditama, Puryono:
This is an open-access article distributed under the terms of the [Creative Commons Atribusi 4.0 Internasional](https://creativecommons.org/licenses/by/4.0/).



ABSTRACT

Indonesia's stunting prevalence 2022 reached 21.6%, which is still high compared to the WHO threshold of 20%. The Indonesian government's target for 2023 is 17% and the target for 2024 is 14%. Stunting is a long-term chronic nutritional condition that disrupts children's growth. In line with the government program, this research was conducted to build an education system & early detection of stunted children using IoT technology. The target users of the system are prospective brides, pregnant women, postpartum mothers and PKK cadres. With the education system and early detection of stunting children, it is hoped that brides-to-be, pregnant women, and postpartum mothers can understand how to prevent stunting babies, and make it easier for users to communicate, consult about stunting babies so that they can reduce the prevalence of stunting according to government targets. The research method used is the classic software development model, which is waterfall.

INTRODUCTION

Indonesia's stunting prevalence rate according to the National Nutrition Status Survey (SSGI) is still quite high at 21.6% in 2022. Meanwhile, the WHO standard for stunting prevalence is below 20%. Therefore, the government targets the stunting rate to fall to 17% by 2023 (Kemenkes, 2023). Stunting is a serious health problem in which child growth is impaired as a result of long-term lack of nutritional intake or chronic nutritional problems. The stunting process begins in the first thousand (1000) days (Bahari, 2019), from the fetus in the womb until the baby is 2 years old. The first 1000 days is the golden period to prevent stunting. Several studies have shown the impact of stunting on children's cognitive development and learning achievement, and this results in low work productivity. Low labor productivity will result in economic growth and increased poverty (Noviyanti, 2023), (Sumartini, 2020), (Anwar and Winarti, 2022).

The lack of community awareness, as well as the lack of knowledge of brides-to-be, pregnant women and breastfeeding mothers about stunting babies is one of the factors causing the high stunting rate. Education about stunting babies is delivered by health workers when Posyandu is held. While Posyandu is held once a month, so mothers have difficulty in consulting with health workers. Based on the above problems, eating to support the Indonesian government programme in reducing the prevalence of stunting. As well as referring to the results of Sylvia Anjani's research in 2022 regarding the level of effectiveness of using mobile applications (Anjani et al, 2022), the researchers have an idea to use smartphones as a means of socialisation and education and early detection of stunting babies. Because smartphones have become one of the needs of today's society, not only as a means of communication but also as a tool for accessing and transferring knowledge.

THEORETICAL REVIEW

IoT (Internet of Things). With the Internet of Thing all devices can be connected to the cloud or to other devices, can communicate, transmit data and control both via wireless networks and the internet. In previous research, Lukman Hakim used IoT technology connected to baby weights, and the results simplified and accelerated the process of measuring and reporting the weight of toddlers (Lukman Hakim, 2023). Similarly, the results of several previous studies, IoT technology can be applied in various tools to monitor smoke concentration, monitor temperature, manage systems and monitor seeds for hydroponics, all of which conclude that IoT technology helps the work system and simplifies the process (Cholish, 2021), (Ikhwanusshofa and Nuramal, 2020), (Fuada et al, 2023). Referring to previous studies, this research utilizes IoT technology, to connect the weighing device to the education and stunting detection system, thus shortening the work of recording, transferring and storing weighing data.

The application development model that researchers use is Waterfall. This model is a classic, systematic and sequential software development model, where the stages start from analyzing, designing, followed by coding, system testing and maintenance. Waterfall is named because each stage must be done in order

from top (beginning) to bottom (last) like waterfall, and cannot be done simultaneously. This model is popular and widely used among software developers. Some previous researchers successfully developed software for archiving systems, e-Tatib applications, Wellies monitoring and Cooperative Savings and Loan Information Systems, using the *Waterfall* method (Kemenkes, 2023), (Cholish, 2021), (Ikhwanusshofa and Nuramal, 2020), (Fuada et al, 2023).

METHODOLOGY

The method and stages of research used are the Waterfall method. The research steps are as follows:

Requirement Analysis

Users of this system can be anyone, but it is mainly intended for prospective brides, pregnant women and nursing mothers. To make it easier for system users and so that the software can be opened anywhere, this application is android-based. The purpose of this system is to educate users about stunting, how to prevent it and detect stunting early. All information about stunting is collected from various literatures and interviews with health workers, then this data and information is processed and analyzed and compiled specifications of user needs.

System and Software Design

This stage aims to provide a general and detailed description of the system components, what to do, the architecture of the software system to be created and determine hardware requirements.

Implementation and Unit Testing

This implementation stage has entered the programming stage, compiling modules which will then be combined. After the modules are combined, their functionality will be tested. Is it in accordance with the wishes or criteria of the user.

RESULTS AND DISCUSSION

Requirement Analysis

From the results of the literature study, interviews with health workers and examination of documents, problem identification can be arranged as in table 1.

Tabel 1. Identification of Problems

Problems	<ol style="list-style-type: none"> 1. Indonesia's stunting prevalence rate is still quite high. 2. Public awareness of stunted babies is lacking. 3. Lack of knowledge on stunting for brides-to-be, pregnant and breastfeeding mothers. 4. Lack of information of handling stunted babies 5. Posyandu is held once a month, making it difficult to consult with health workers. 6. Lack of stunting education applications.
Influences	<ol style="list-style-type: none"> 1. Low cognitive development and learning achievement, low labor productivity. 2. Decrease in stunting prevalence rate is low. 3. Prospective brides, pregnant women and breastfeeding mothers data do not know how to prevent stunting babies and how to detect early stunting and how to follow up to overcome stunting babies.
Impacts	<ol style="list-style-type: none"> 1. Economic growth is stunted and poverty increases. 2. The child's growth and intelligence are impaired. 3. The risk of childhood obesity is high and makes it difficult for children to perform basic daily activities.
Solution	Designing an education system platform and early prevention of stunting toddlers using IoT technology.

User Identification:

General public, especially for brides-to-be, pregnant women, nursing mothers.

Specification of IoT-based Stunting Education & Early Detection System:

1. The system displays information about the incidence of stunting and the impact and dangers of stunting.
2. The system educates users on what stunting is, the causes, and prevention measures.
3. Early detection of stunting by recording infant weight and height measurements.
4. The system displays a list of healthy menus for toddlers for stunting prevention.

Hardware requirements to build the system:

1. Processor : Intel Core i5 1.6GHz
2. Memory : 12 GB DDR4
3. Operation System *Windows 10 Home* 64 bit;
4. Digital body weighing device

Smartphone needs to run the system, at least with specifications:

1. Processor : *Octa Core* 4x2.8 GHz *kyro 385 gold*;
2. Memory : 6 GB;
3. Operation System : *Android PIE*;
4. Storage : 128 GB.

The software requirements to create this system are:

1. Create use case diagrams and sequential diagrams: *Visual Paradigm Online*

2. Menggabungkan beberapa obyek : *Unity 3D*
3. Programming Language: Java

System Design

The initial stage in designing a system is designing a storyboard, this storyboard contains a series of activities or system scenarios. An overview of the scenario of this Iot-based education and early detection system for stunting can be seen from the following table:

Table 2. Storyboard description of stunting education and early detection system

No	Scene	Contents	Description
1	Scene 1	STMIK AKI logo page	The initial display is an animation of the STMIK AKI logo
2	Scene 2	Start page	Contains the start button.
3	Scene 3	Home page	Contains several menu buttons: Stunting, Education, Early Detection, Healthy Toddler Menu list
4	Scene 4	Stunting page	Contains the definition of stunting, the dangers of stunting, the impact of stunting, the characteristics of stunting, the causes of stunting, the incidence of stunting, the role of the government and information on normal weight and height of toddlers.
5	Scene 5	Education page	Contains steps to prevent stunting, how to detect early stunting, how to measure the weight and height of toddlers, how to follow up if stunting is found.
6	Scene 6	Detection page	Contains initial checking steps, measuring toddler height, measuring toddler weight, reading checking results, consultation room
7	Scene 7	Toddler Healthy Menu Page	Contains a list of Healthy Toddler Menus and their nutritional values

Navigation Structure Design

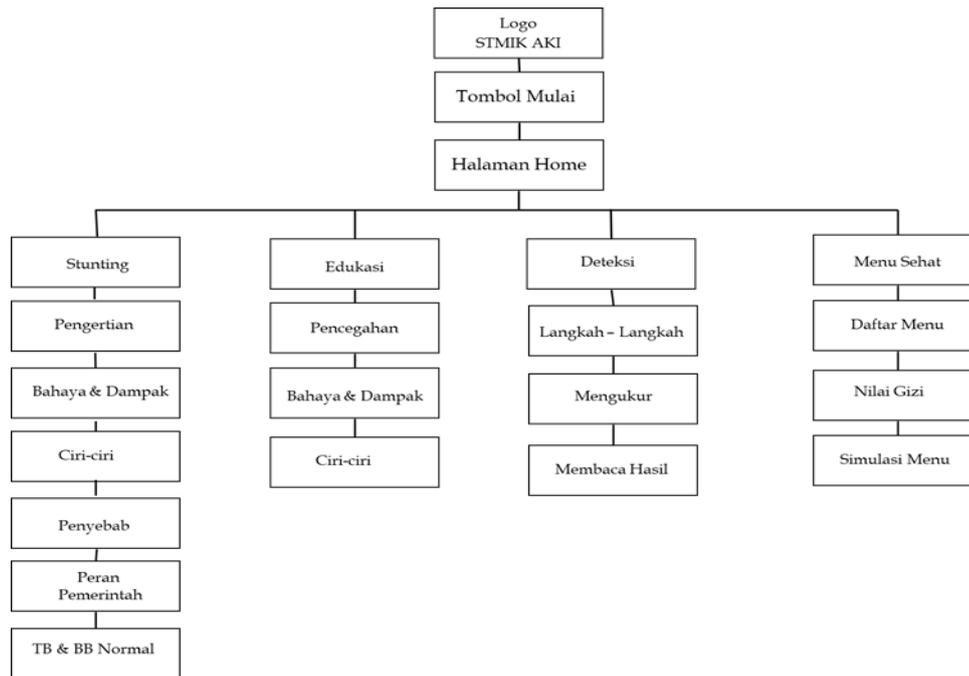


Figure 1. Navigation Structure Design

Preparing the Material

To design this educational system and early detection of stunting, several supporting materials are needed, such as :

1. Images: taken from personal collections and from the internet.
2. Video: video creation from multiple images using Kine Master.
3. Voice: the voice that contains some explanations is done with a softening of the voice.
4. Music: music is used for back sound and button click sound effects.

Proposed Use Case Diagram

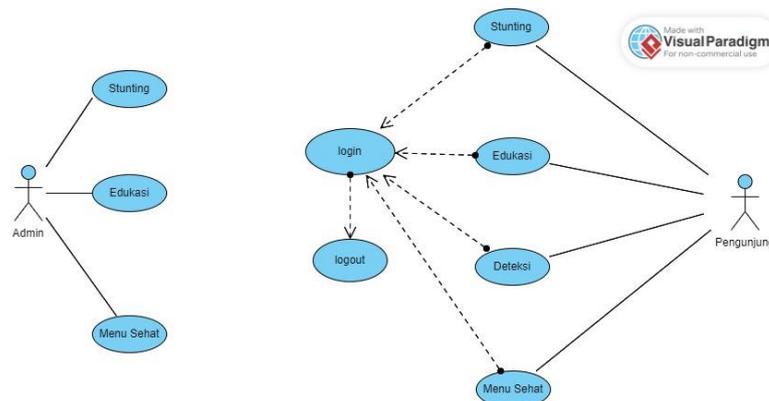


Figure 2. Use Case diagram of proposed stunting education & early detection system

Use Case Diagram of the proposal above there are two actors, namely admin and visitors. Admin manages (input, add, edit, delete) stunting data, manages (Education), manages (Healthy Menu). Visitors can get all the information about

stunting, can see all the contents of Education, can access and detect and see a list of healthy menus and simulations compiling menus.

Sequential Diagram

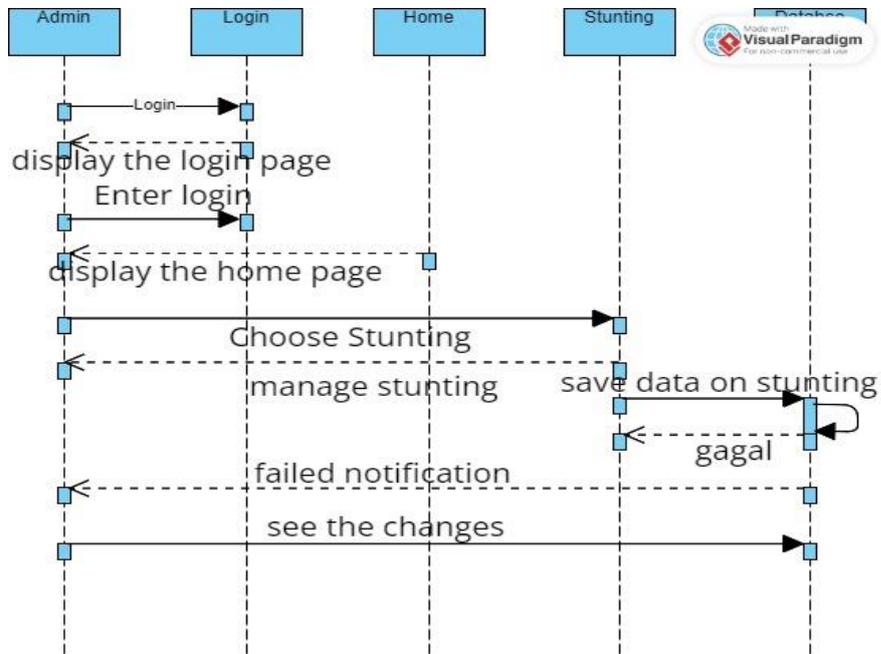


Figure 3. Sequential Diagram Admin Manage Stunting Menu

The picture above is the admin process of managing the stunting menu. Admin logs into the system, on the Home page select the Stunting menu, Manage data about stunting (enter, edit, delete and save).

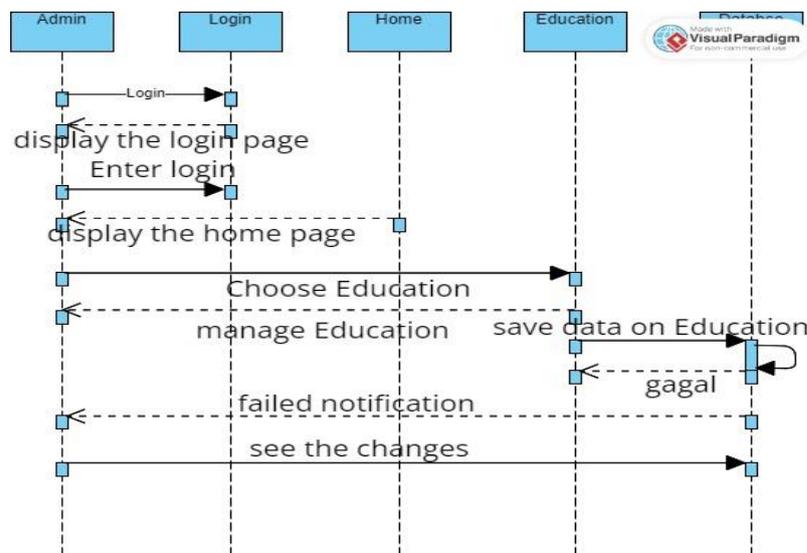


Figure 4. Sequential Diagram Admin Manage Education Menu

The picture above is the admin process of managing the Education menu. Admins enter education data, edit, add, delete and save data about Education.

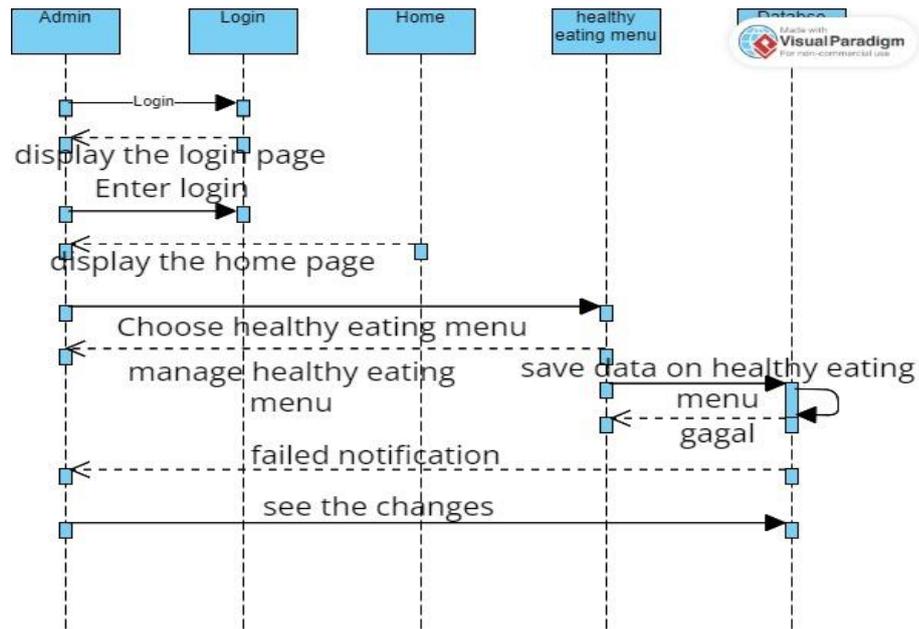


Figure 5. Sequential Diagram of Admin Managing the Healthy Food Menu
The figure above is the admin process of managing the healthy food menu.

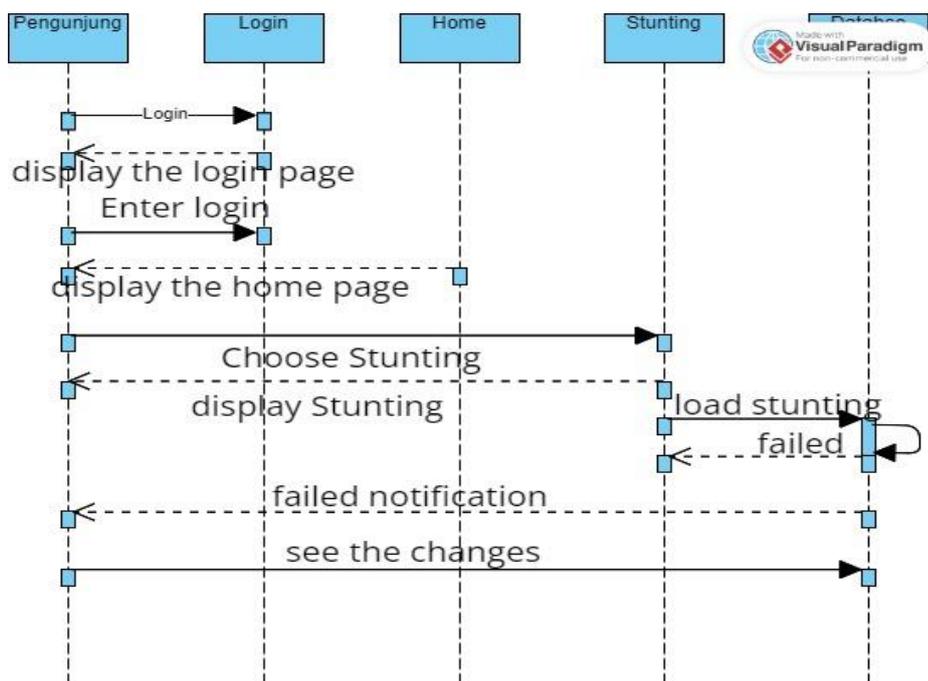


Figure 6. Sequential Diagram Pengunjung Melihat Menu Stunting
The figure above explains the process of how visitors see the Stunting menu.

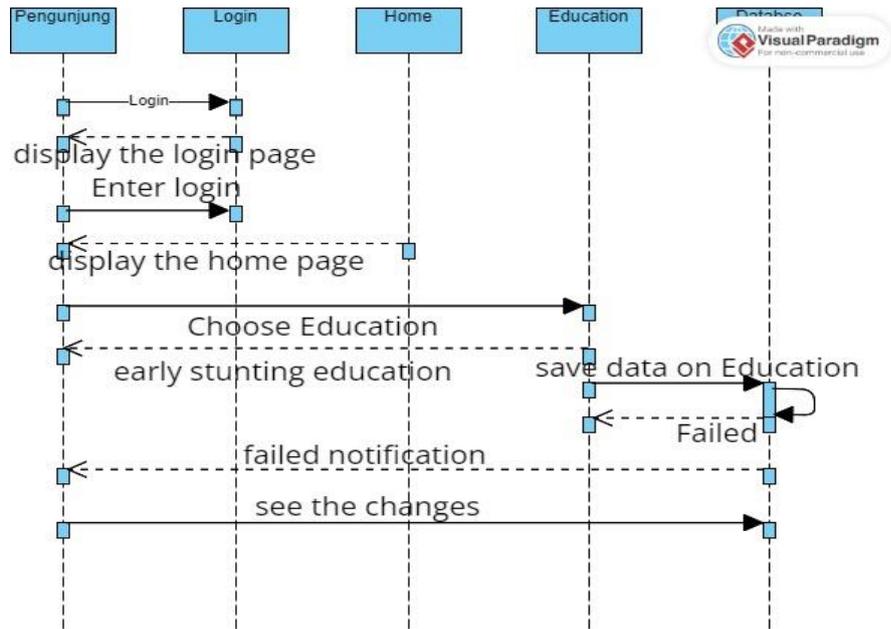


Figure 7. Sequential Diagram of Visitor Accessing the Education Menu
The figure above is the process or stages of visitors accessing the Education menu

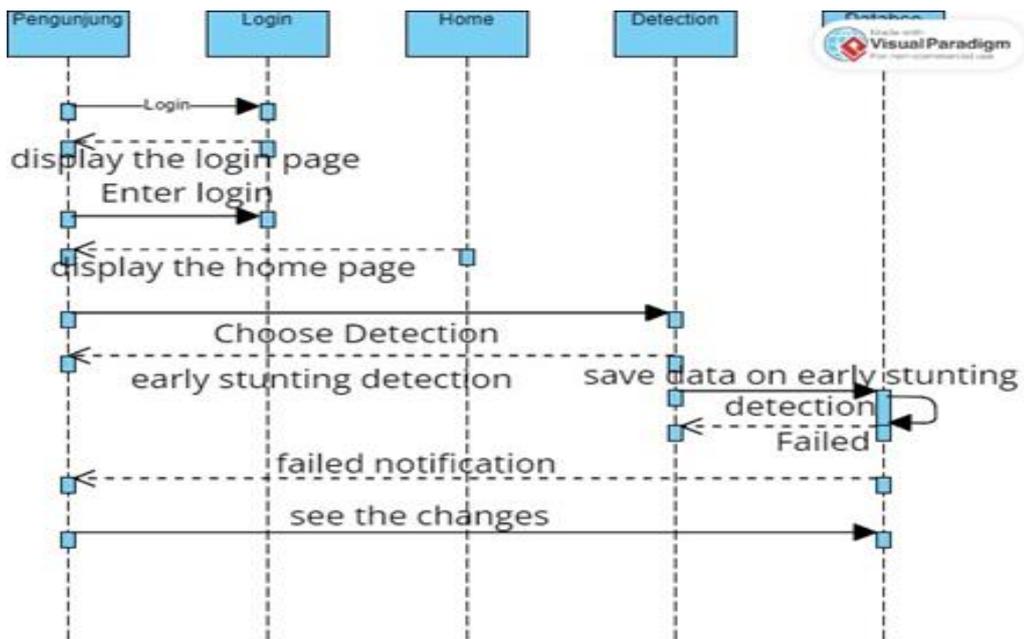


Figure 8. Sequential Diagram of Visitor Accessing the Detection Menu
Figure 8 shows how the Visitor process enters the Detection Menu, here visitors can perform initial stunting detection.

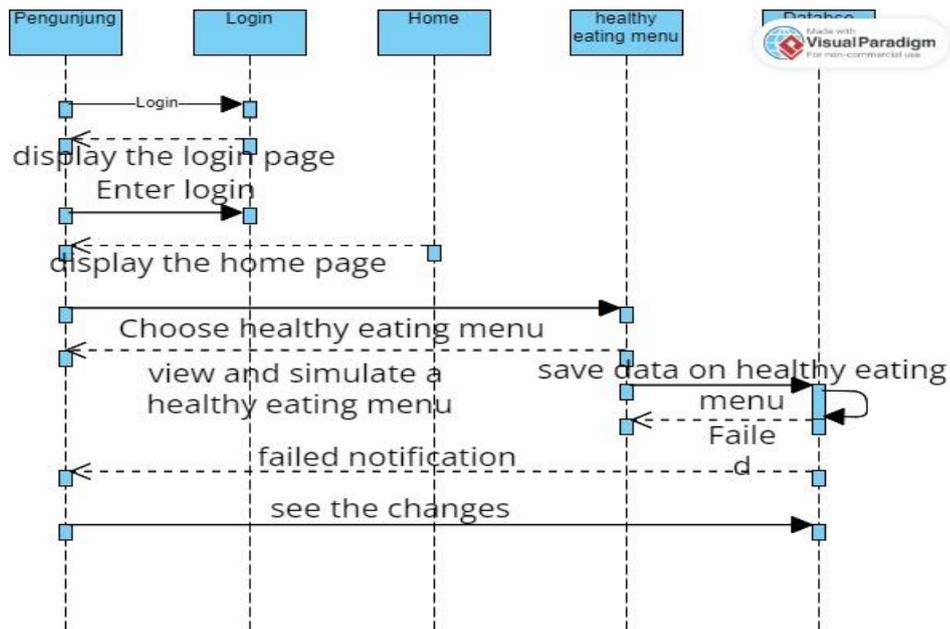


Figure 9. Sequential Diagram of Visitor access to Healthy Eating

The figure above shows the stages of visitors accessing the Healthy eating menu. Besides being able to see a list of healthy food menus, visitors can also simulate compiling a healthy food menu.

CONCLUSIONS AND RECOMMENDATIONS

From the results of this study can be drawn conclusions:

1. This IoT-based stunting education and early detection system design can be used as a blue print for the IoT-based stunting education and early detection system design system.
2. This system makes it easier for the general public, especially prospective brides, pregnant women and breastfeeding mothers to obtain information about stunting, can learn about the causes of stunting, characteristics, prevention and follow-up if stunting occurs, can learn to compose a healthy menu for toddlers.

FURTHER STUDY

The results of the design of this IoT-based stunting education and early detection system can be continued to implementation in further research.

REFERENCES

- Abdullah, Cholish, Moh. Zainul Haq, "Pemanfaatan IoT (*Internet of Things*) Dalam Monitoring Kadar Kepekatan Asap dan Kendali Camera Tracking", *CIRCUIT: Jurnal Ilmiah Pendidikan Teknik Elektro*, Vol.5, No.1, 2021.
- Baibul Tujni, Hutrianto, "Pengembangan Perangkat Lunak Monitoring Wellies Dengan Metode Waterfall Model", 2020, *Jurnal Ilmiah Matrik* Vol 22 No 1.
- Erwina Sumartini, "Studi Literatur : Dampak *Stunting* Terhadap Kemampuan Kognitif Anak", Prosiding Seminar Nasional Kesehatan "*Peran Tenaga Kesehatan Dalam Menurunkan Kejadian Stunting*" Tahun 2020.
- Galuh Saputri, Emi Sita Eriana, "Implementasi Metode *Waterfall* Pada Perancangan Sistem Informasi Koperasi Simpan Pinjam Berbasis Web Dan Android (Studi Kasus Pt. Peb)", *Jurnal Teknik Informatika* Vol. 13 No. 2 2020.
- Isa Faqihuddin Hanif¹, Ghifar Marhaban Sinambela, "Pembuatan Aplikasi E-Tatib Berbasis Android Menggunakan Bahasa Pemrograman Dart", *Jurnal Teknologi dan Terapan Bisnis (JTTB)* Vol. 3, No. 2, 2020.
- Kemenkes.(2023). Hasil Survei Status Gizi Indonesia (SSGI)2022.
- Lukman Hakim, "Sistem Informasi Status Gizi Anak dan Timbangan Bayi Berbasis IoT Untuk Pendeteksian *Stunting*" *SESSION* Volume 01, Nomor 02, 2023.
- Muhammad Ikhwanusshofa, Agus Nuramal, Nurul Iman Supardi, "Pemanfaatan Internet Of Things Untuk Monitoring Suhu Di BPPT-Meppo", 2020, *REKAYASA MEKANIK* Vol.4 No.1.
- P. D. Bahari, "Sosialisasi *Stunting*. Sosialisasi *Stunting* UPT Puskesmas Garawangsa." 2019.
- Ratna Noviyanti, Indri Mulyasari, "Hubungan Tinggi Badan Ibu, Riwayat Kekurangan Energi Kronis (KEK), dan Usia Ibu Saat Hamil dengan Kejadian *Stunting* pada Batita Usia 12-35 Bulan Di Desa Mojokerto, Kecamatan Kedawung, Kabupaten Sragen", *JGK*-Vol.15, No.2 Juli, 2023.
- Ridwanto, Dwi Ade Handayani Capah, "Aplikasi Pengelolaan Dokumen dan Arsip berbasis Web untuk mengatur Sistem kearsipan dengan menggunakan Metode Waterfall", *Explore (Jurnal Sistem Informasi dan Telematika, Telekomunikasi, Multimedia dan Informatika)* Vol.11 No.2, 2020.
- S. Anjani, Fitria Dewi Puspita Anggraini, Aprianti, Vilda Ana Veria Setyowati,

Agustina Nur Indriati, "Efektivitas Metode Edukasi Berbasis Mobile Edu App Sebagai Upaya Intervensi Penurunan Stunting Dengan Pendekatan Asuh, Asih, Asah", *Jurnal Eduscience*, 2022.

Saiful Anwar, Eko Winarti, Sunardi, "Systematic Review Faktor Risiko, Penyebab Dan Dampak Stunting Pada Anak", *Jurnal Ilmu kesehatan*, Vol.11, No.1 2022.

Syifaul Fuada, Endah Setyowati, Dwi Wahyu Riani, Galuh Inti Aulia, "Narrative Review Pemanfaatan Internet-Of-Things Untuk Aplikasi Seed Monitoring And Management System Pada Media Tanaman Hidroponik Di Indonesia", 2023, *INFOTECH journal*, Vol 9 No. 1.