SIPANDAI: Development of an Integrated Village Public Service Website Using the Agile Method

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ARTICLE INFO	ABSTRACT
Keywords: Agile Digital village Public services Information system Website	The development of information technology has encouraged the transformation of public services in villages to be more efficient and transparent. This research aims to develop the Integrated Village Information and Service System (Sipandai) website to overcome administrative problems such as population data collection, correspondence, and access to information. Sipandai provides digital administration features, budget transparency, village news, and online levy payments. The system development uses the iterative and flexible Agile method, allowing for customization according to the user's needs. The results of the development show that the implementation of Agile supports the effectiveness of the system, improves the quality and speed of public services in the village, and encourages community participation in more transparent governance. Sipandai also functions as a means of community empowerment and strengthening information technology-based village governance. The test results using the Black Box and White Box methods showed a 100% success rate with no errors found in all test scenarios
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INTRODUCTION

The development of information technology in the era of the industrial revolution 4.0 has brought major changes in various sectors, including public services in villages. Information technology is now not just a tool, but a strategic component that produces accurate, fast, and relevant information to support decision-making [1]. In village services, the need for a computerized information system is increasingly important to improve access to information, administrative efficiency, and the quality of community services [2]. In addition to efficiency, this system must also be in accordance with the principles of good governance. Law No. 25 of 2009 emphasizes that local governments are obliged to provide effective and efficient communication media for the sake of a transparent and accountable government. Experts also stated that the use of technology in public services can improve service quality and speed up administration [3].

The main problems in the village office are the management of population data and the administration of correspondence. If it is not systematic, this hinders public services. Setiawan et al. (2022), citing Supriadi et al. (2015), said that many village administrative processes are not optimal [4]. Many villages have not made full use of technology, even though technology can be a solution to the slow response to complaints and low information disclosure [5]. Manual procedures lead to data delays, risk of input errors, and duplication of documents. Previous research by Kurniawan et al. (2020) showed that the web system makes it easier for village devices and residents to access services without having to come to the office [6]. Research by

Windyasari and Anam (2023) in Sindangsari Village only highlights basic administrative services, such as submitting certificates and managing population data online [7]. The system has indeed succeeded in reducing manual processes and speeding up administrative services. However, the scope is still limited to the management of letters and general information of the village.

In addition, research conducted by Azrah Cipta Amandha and his team in 2023 created a website-based village service system in Durin Jangak Village. This system was created to replace the old manual service process with a web-based digital system. In their manufacture, they use the Waterfall method [8]. However, this method is sequential, where each stage must be completed before proceeding to the next. This makes it difficult to adjust to changing needs along the way. If there are changes, the work that has already been done may have to be repeated, and this can create new problems [9].

In contrast, the Sipandai system in this study offers more complete and integrated features. In addition to correspondence and population data collection services, Sipandai is equipped with an online levy payment feature. This feature makes it easier for residents to pay taxes or village dues more easily and transparently. A budget transparency feature is also available, which allows the public to access village financial information directly. This encourages accountability and prevents potential corruption. In addition, there is a news and announcement management feature, which helps village officials convey important information to all residents, including those who live in remote areas or rarely come to village offices.

With these advantages, the Sipandai system is expected not only to be an administrative tool, but also as a means of community empowerment and strengthening technology-based village governance. In contrast to linear approaches such as Waterfall, Sipandai's development uses a more flexible and iterative Agile methodology. Development is carried out in several stages, namely identification of needs, design, development, testing, and evaluation and implementation of web-based systems repeatedly, so as to be able to adjust to the dynamics of user needs in the field.

Based on the existing problems, this study aims to develop the Integrated Village Information and Service System (Sipandai) website to facilitate population data collection and mail management, as well as accelerate services with technology. Thus, it is hoped that this website can help the village community in accessing services more easily, quickly, and without having to come directly to the village office.
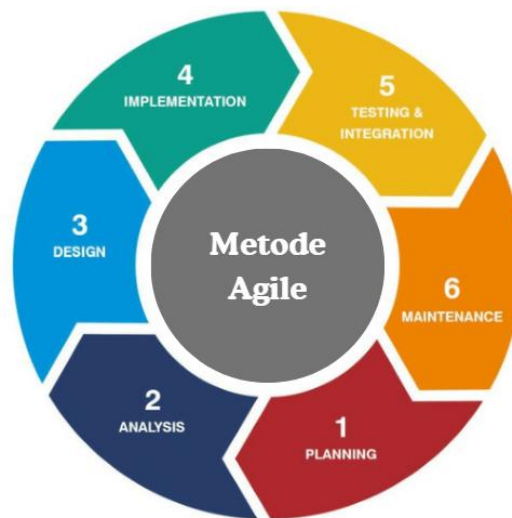
METHOD

Software development methods are a series of activities and frameworks used to plan, design, apply, control, and support the information system development process [10].

In this study, the researcher applies the Agile software development method in the information system development process. The Agile method is a software development approach that emphasizes flexibility, team collaboration, and fast, iterative product delivery [11]. This method divides large projects into a number of small parts that are worked on gradually and routinely to be delivered to the user. This stage is known as iteration or sprint [12].

The Agile method allows for gradual development of the system, with a focus on delivering features that have high added value in each iteration. This allows stakeholders to start using the system early and provide valuable feedback, thus ensuring that the resulting system meets their expectations. Effective collaboration between team members is also key in the use of this method, ensuring open communication and quick problem-solving [13].

With the application of the Agile method, the information system development process in this study is expected to run more efficiently and responsive to user needs.

Picture 1. Stages of the Agile Method

Figure 1 shows a flowchart of the Agile development method which consists of six main stages: Planning, Analysis, Design, Implementation, Testing and Maintenance. This diagram illustrates the iterative and connected process, reflecting flexibility and iterability in each stage of system development.

Planning

At this stage, the team planned an integrated village service system that allowed residents to access information and services online without the need to come to the village office [14]. Planning starts with the identification of user needs, key features, and expected outputs [5].

Analysis

The analysis was carried out to identify problems in village services and organize them into more specific sections. This is so that the system solution is right on target. The analysis also includes functional needs such as citizen data collection, application processing, and notification delivery [15].

Design

The system design was made based on the results of analysis with structured modeling using UML. This design includes a user interface and database structure to keep development running as needed [5][16].

Implementation

The development of the system is carried out in sprints, with regular coordination through *stand-up meeting* to overcome obstacles and monitor progress [13]. Implementation includes system installation, user training, and initial testing [4].

Testing

The testing stage is carried out to ensure that the system runs according to the design and needs of the user. The main focus of testing is to ensure that all features can function properly and that no errors are found before the system is widely used [5]. In this study, the testing process was carried out by 10 villagers as participants in the system validation, so that the evaluation results reflect the experience of direct users.

Maintenance

After implementation, the system is maintained based on user feedback. This stage aims to maintain system stability and adapt to evolving needs [11].

RESULTS AND DISCUSSION

The result of the development is in the form of a village integrated service website called SIPANDAI, which is designed to make it easier for the community to access village information and services digitally. This website is intended for village officials and the community as the main user. System development uses the Agile method, which consists of six stages, namely: Planning, Analysis, Design, Implementation, Testing, and Maintenance. The presentation of each stage of Agile development is as follows:

Planning

The planning stage began with an interview with village officials to find out information about the needs of the system needed in village administration services. The results of the interviews were then summarized in the system request document, which showed the need for a digital platform to manage village services in an integrated and efficient manner. The document is further analyzed through a feasibility study to ensure that the development of the system can be carried out with the available resources. This analysis also plays a role in assessing the chances of project success, identifying risks that may arise, and providing the development team with an initial understanding of the challenges that will be faced during the system implementation process [17].

Table 1. System Request

SiPandai (Integrated Village Information and Service System)				
Business Need	**Disagree**	**Nervous**	**Setuju**	**Strongly agree**
SiPandai can improve services and information efficiency to the village community.	☐	☐	☐	☑
SiPandai can reduce village operational costs	☐	☐	☑	☐
SiPandai can increase the work productivity of village officials.	☐	☑	☐	☐
SiPandai is able to increase intangible added value for villages.	☐	☐	☑	☐
Business Value	Intangible Value: 1. Improving the quality of village public services. 2. increase transparency and accountability of village government.			

3. Increase community participation in decision-making.
4. Accelerating the administrative process and management of village data.
5. Increase community trust in village government.

Tangible Value:

1. Reduced operational costs:
   - ✓ ATK Fee: Rp. 15,000,000,-/year.
   - ✓ Printing fee: Rp. 25,000,000,-/year.
   - ✓ Official travel expenses: Rp. 10,000,000,-/year.
   - ✓ Communication fee (telephone, correspondence): Rp. 8,000,000,-/year.
2. Increased time efficiency:
   - ✓ The administrative process time is reduced by up to 50%.
   - ✓ Data processing and reporting is faster and more accurate.
3. Increase in village income:
   - ✓ Optimization of village taxes and levies through a digital system.
   - ✓ Efficiency in village budget management.
4. Reduced use of physical resources:
   - ✓ Reduced printer paper and ink consumption
   - ✓ Reduce the need for document storage space
5. Improved service accessibility:
   - ✓ The community can access village services online
     Reduction of queues and waiting times at village offices

Business Requirements
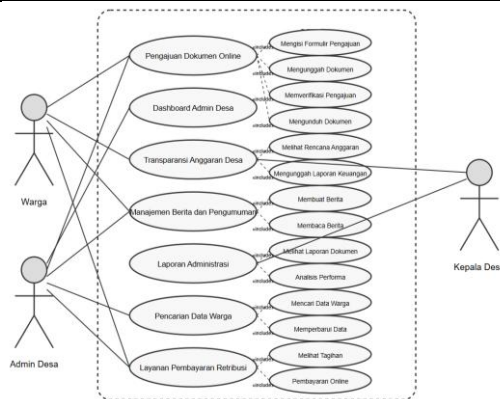
Gambar 2. Business Requirements

Special Issues   SiPandai's success requires a specific strategy in data security, fair incentives, and payment integration. Privacy is maintained with encryption, authentication, and transparent policies. The algorithm ensures fair incentives, while payment integration simplifies transactions and service efficiency, making SiPandai a secure and efficient digital solution for village governance.

Table 2. Feasibility Study

SiPandai Information System Feasibility Study

Technical Feasibility

SiPandai can be implemented with web-based and mobile technologies, using cloud or on-premise servers. However, it is worth noting that the network infrastructure in the village may still be limited, so alternatives such as VSAT or mobile networks can be used for connectivity.

Economic Feasibility

The cost of developing and implementing the system can be categorized as a long-term investment, with potential operational savings through the digitization of services. Reducing the cost of printing documents, saving village officials' working time, and efficiency in services can be significant economic value.

Legal and Regulatory Feasibility

The system must be in accordance with applicable regulations, such as the Village Law No. 6 of 2014 and the Personal Data Protection Regulation to maintain the security of citizens' information. In addition, regulatory support is needed related to administrative digitalization Villages from the local and central governments.

Operational Feasibility

Village officials need to be given training to operate SiPandai properly. The system must have a user-friendly interface so that it can be easily used by village and community devices. Technical support also needs to be provided to ensure operational sustainability.

Social and Cultural Eligibility

Public acceptance of the digitalization of village services can vary. Therefore, socialization and education are needed so that the public can understand the benefits of this system. Multilingual features or local adaptations can also help in increasing the adoption of the system in various villages.

Security and Risk Feasibility

Citizens' data must be protected with strong encryption and authentication systems to avoid information leakage. In addition, there needs to be periodic data backups and risk mitigation strategies in the event of a system failure or cyberattack.

Analysis

The analysis stage focuses on the formulation of the functional and non-functional needs of the application, including the Document Submission feature, Admin Dashboard, Budget Transparency, News Management, Administrative Reports, Citizen Data Search, and Levy Payment, details of which are in Tables 3.4 and 3.5.

Tabel 3. Non Functional Requirements

ID	Parameter	Necessity

NFR-001	Availability	The application must operate continuously for 7 days per week, 24 hours per day without fail, except during scheduled system maintenance.
NFR-002	Reliability	The system reliability level is at least 99.5% with a fault-tolerant architecture to avoid fatal failures in critical services.
NFR-003	Ergonomy	The user interface must be user-friendly, easy to understand, and support accessibility for all groups, including users with certain limitations.
NFR-004	Portability	The app must be interoperable on a variety of devices (PCs, tablets, and smartphones) and compatible with Windows, Android, and iOS operating systems without losing key features.
NFR-005	Memory	The application must be optimized to run with efficient memory consumption, not exceeding 500MB of RAM on the user's device.
NFR-006	Response time	Each user request should get a response within a maximum of 4 seconds under normal network conditions.
NFR-007	Safety	N/A
NFR-008	Security	The system must have a data encryption mechanism for communication and transactions, as well as user authentication features to prevent unauthorized access.
NFR-009	Others: Language of communication	All displays and interactions in the system must be in Indonesian for ease of use.

Tabel 4. Functional Requirements

ID	Parameter	Necessity
FR-001	Online Document Submission	This feature allows residents to submit various village administrative documents online, such as domicile certificates, SKTM, and others. Users can upload supporting documents and track the status of the submission.

| FR-002	Village Admin Dashboard	Village admins have access to the dashboard to manage citizen data, process document submissions, and supervise system operations efficiently.
FR-003	Village Budget Transparency	The system provides a feature to display village financial statements openly, including income, expenditure, and fund allocation in a format that is easy for the community to understand.
FR-004	News and Announcement Management	Village admins can create, edit, and delete news and announcements displayed to residents to improve communication and public information.
FR-005	Administrative Report for Village Head	The system must be able to produce comprehensive administrative reports, including population data, recaps of document submissions, and financial statements that can be accessed by village heads.
FR-006	Citizen Data Search	This feature allows village admins to search for citizen data based on NIK, name, or address to facilitate population administration management.
FR-007	Levy Payment Services	Residents can make village levy payments online, such as village taxes or cleaning dues, through various payment methods available.

In addition to formulating functional and non-functional needs, the analysis process is also supported by UML diagrams such as use case diagrams that describe the scenario of using the system by the actors involved [18]. And activity diagrams to show the system process flow in a structured manner [19]. These two diagrams ensure the needs of the system are fully accommodated, which can be seen in Figures 3 and 4.

Gambar 3. Use Case Diagram

This diagram illustrates the interaction between the three main actors in the SiPandai system: Citizens, Village Admins, and Village Heads. Residents have access to file documents online, view the transparency of the village budget, and read news and announcements. The

Village Admin manages the system, verifies the submission of documents, makes news and announcements, and manages administrative reports and levy payments. The Village Head, as a supervisor and decision-maker, has access to upload financial reports, make official news, and access administrative reports for evaluation of village service performance.
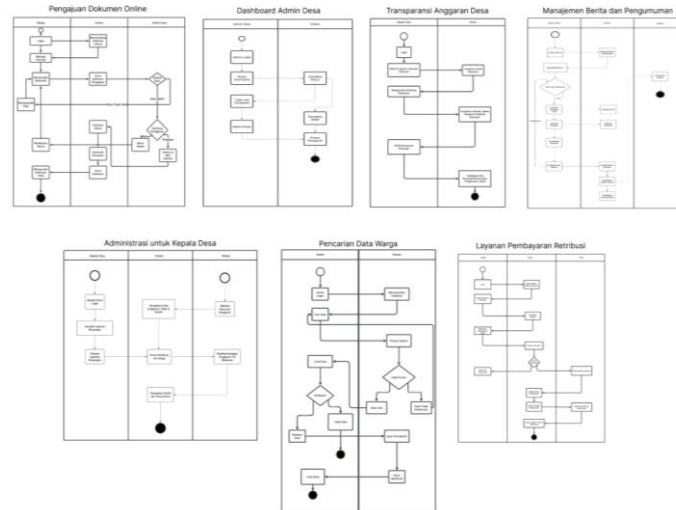

Gambar 4. Activity Diagram

Design

The design stage in this study produced a design in the form of a Class Diagram, Sequence Diagram, and user interface (UI) which was designed and adjusted to the features contained in the Sipandai website: Integrated Village Information and Service System.

a. Use Case Design and Class Diagram

For visual design of programs, Unified Modeling Language (UML) is used as a framework or modeling language for object-oriented programming, UML modeling helps to simplify complex problems to make them easier to understand and learn [18]. At this stage, modeling involves creating a class diagram that is used to define the class structure to be used in the application, including the attributes and methods that matter, as well as the relationships between classes [20] which can be seen in figure 5.
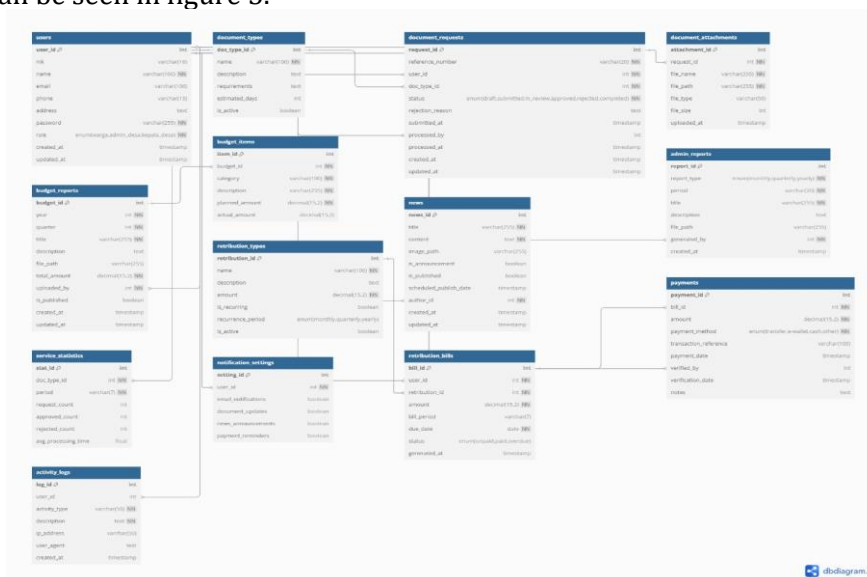

Gambar 5. Class Diagram

Sequence diagrams are used to illustrate the interactions between objects within a given period of time in a process, as well as provide structured guidance on the sequence of execution of operations in an application based on each use case [21]. A detailed explanation is shown in Figure 6.
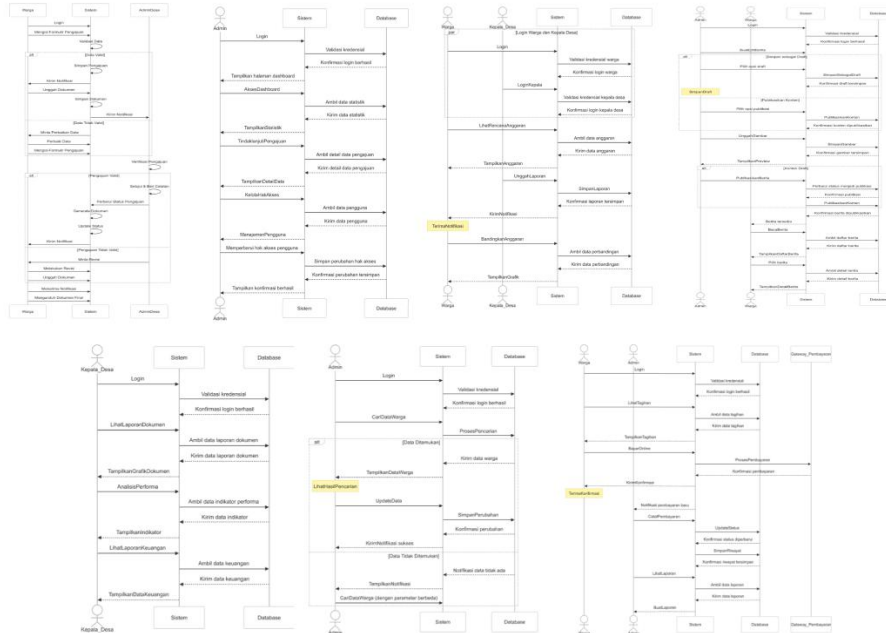
Gambar 6. Sequence Diagram

b. Desain User Interface (UI)

Furthermore, the UI design is designed based on functionality using the Figma design application and refers to the style guide. The application of UI design principles results in a consistent, solid, and harmonious interface, with improvements in color, type, and font size as per the design system [22]. Some icons are taken from Figma's free collection, and the final design of the UI is displayed via the following feature images:
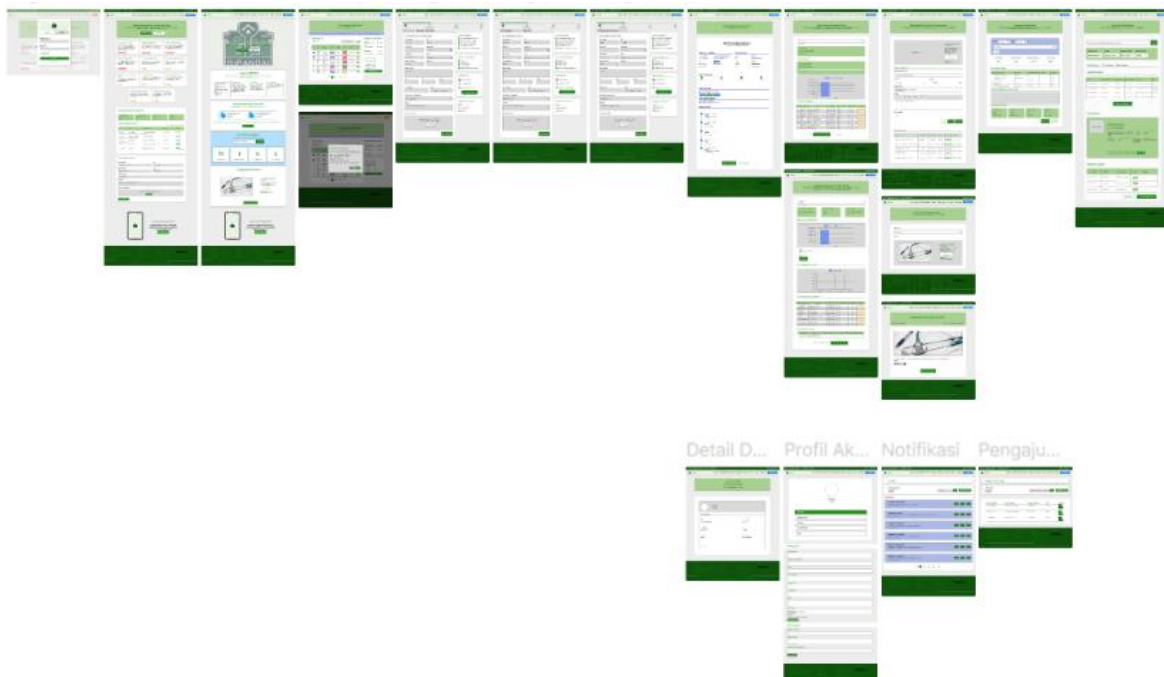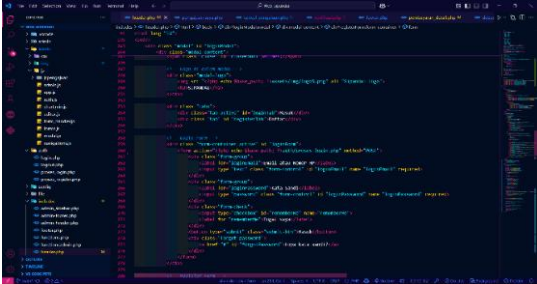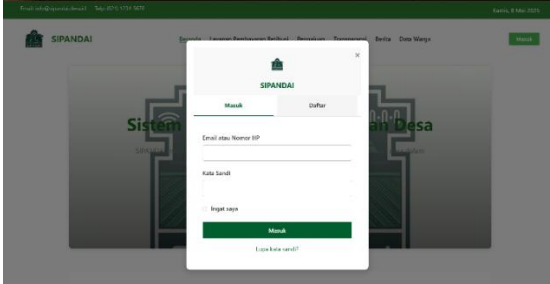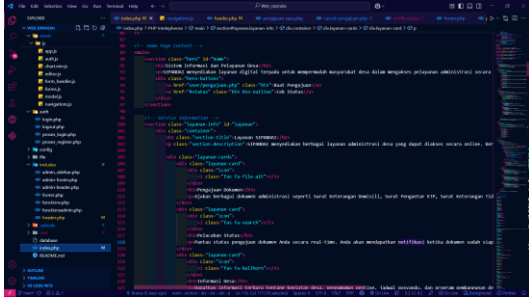
Gambar 7. Sequence Diagram

Implementation

The coding stage resulted in the implementation of the Sipandai Website: Integrated Village Information and Service System using Visual Studio Code with the Java programming language. MySQL is used as a backend database because of its efficiency, extensive integration, and ease of use.

Table 4. Program Code and Its Output

Coding	Results Display
Login and Register	

Figure 8. Login Page Code Display

Figure 9. Login Page UI

Porch

Figure 10. Home Page Code Display

Figure 11. Home Page UI

Levy Payment Services
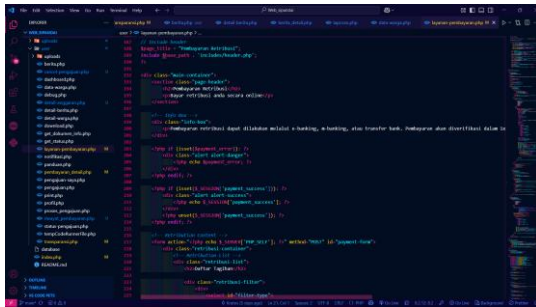
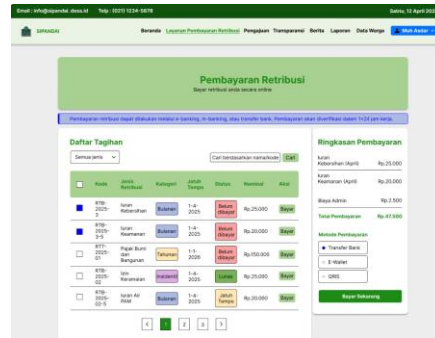**Figure 12.** Levy Payment Service Page Code Display

Figure 13. UI Levy Payment Service Page
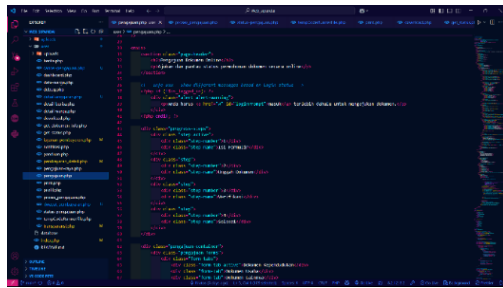
Filing

Figure 14. Submission Page Code Display
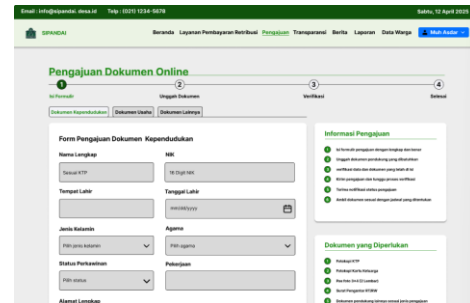

Figure 15. Application Page UI

Transparency
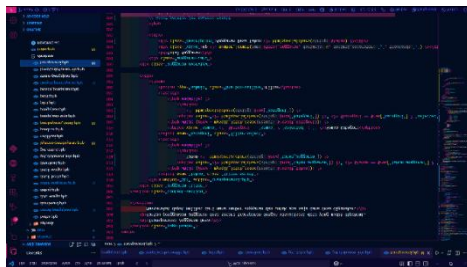
Figure 16. Transparency Page Code Display
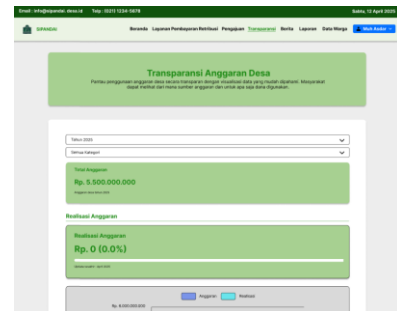

Figure 17. UI Page Transparency

News

Figure 18. News Page Code Display
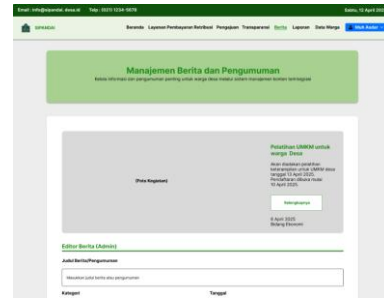

Figure 19. News Page UI

Citizen Data
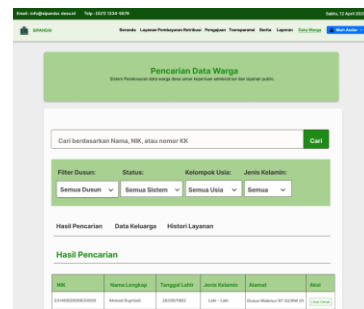

Figure 20. Citizen Data Page Code Display

Figure 21. Citizen Data Page UI

Profile

Figure 22. Profile Page Code Display

Figure 23. Profile Page UI

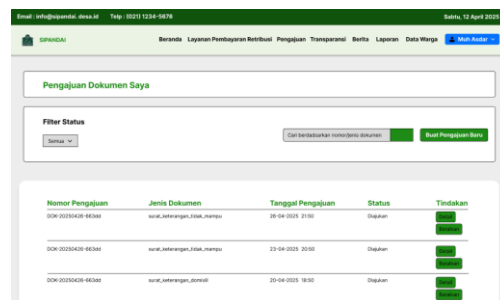**My Submission**

Figure 24. My Submission Page Code Display

Figure 25. My Application Page UI

Link Github	https://github.com/kratos2705/SIPANDAI.git

Testing

Website testing is carried out through two methods, namely Black Box and White Box; Black Box is done by users to test functionality without knowing the program code, while White Box is done by developers by thoroughly examining the logic and flow of code to ensure the system is running as planned.

Table 5. Black Box Testing SIPANDAI

Code	Category	Tested Features	Test Results	Status
BB - 1	User Management	Registration, Login, Logout, Edit Profile, Change Password	Validation Accordingly	Succeed
BB – 2	Document Submission	Application Form, Document Upload, Status Check, Cancel Application, Download Document	Validation Accordingly	Succeed
BB – 3	Levy Payment	View Bills, Filter Bills, Pay Bills, Upload Evidence, Payment Details and History	Validation Accordingly	Succeed
BB – 4	Budget Transparency	View Budget, Year/Category Filters, Chart Visualization, Realization Details	Validation Accordingly	Succeed
BB – 5	Notification System	View Notifications, Filters, Mark Read, Delete Notifications	Validation Accordingly	Succeed
BB – 6	News and Announcements	View News, Category Filters, News Details, Pagination, View Appendices	Validation Accordingly	Succeed
BB - 7	Citizen Data	View Citizen Data, Hamlet/Gender Filters, Searches, Citizen Details	Validation Accordingly	Succeed

Table 6. White Box Testing SIPANDAI

Code	Category	Parts of Code Tested	Test Results	Status

WB - 1	Authentication & Security	proses_login.php, functions.php	Validate inputs, accounts, passwords, and sessions	Succeed
WB – 2	Document Submission Process	proses_pengajuan.php	Data validation and file uploads run optimally	Succeed
WB – 3	Document Status Management	status-pengajuan.php, cancel-pengajuan.php, functions.php	Data capture, timeline validation, and cancellation went smoothly	Succeed
WB – 4	Payments & Levy	layanan-pembayaran.php, pembayaran_detail.php	Fine calculation, validation, and payment cancellation went well	Succeed
WB – 5	Budget Transparency	transparansi.php, detail-anggaran.php	Prepared statements, calculations, filtering, and data preparation went well	Succeed
WB – 6	User Profile & Data	profil.php, detail-warga.php, data-warga.php, functions.php	Data updates, password verification, citizen data collection, and input sanitation run smoothly	Succeed
WB - 7	News & Announcements	berita.php, detail-berita.php	News capture with pagination, category filtering, view enhancement, and attachment management runs smoothly	Succeed

Maintenance

The final stage of the development of the SIPANDAI information system is *maintenance* or system maintenance, which aims to keep applications running well, stable, and safe to use in the long term [23]. This maintenance includes periodic checks of system files, storage capacity, data security, as well as smooth links and other important features. This is important to prevent performance disruptions due to data growth, file system errors, or changes in process flow [24].

In the web-based SIPANDAI system, maintenance also involves monitoring activities by admins, such as monitoring visitor traffic, evaluating storage space (hosting), and updating village service content to keep it relevant and informative. Maintenance steps are carried out periodically, including data and template backups, bandwidth checks, and optimization of integration with search engines (*search engine*) [25].

With regular *maintenance*, the SIPANDAI system can continue to provide effective services, maintain the security of villagers' data, and ensure that applications can still be used according to the needs and developments of the village.

Discussion

SIPANDAI is designed as a web-based village service information system that aims to improve the efficiency, transparency, and speed of population administration services at the village level. When compared to the systems developed in the study [26] which uses the Android platform, SIPANDAI has advantages in terms of range and cross-device compatibility because it is web-based, so it can be accessed through various types of gadgets. Research by [27] which also developed a web-based system with an automatic data search and recap feature shows the same approach, but SIPANDAI added a real-time mail tracking feature that supports higher transparency in the administrative process. Information systems developed by [28], although it has switched from manual to web-based systems, it is not yet equipped with multi-level authentication features like SIPANDAI, which plays an important role in improving the security of population data.

In addition, the system in the study [29] has covered various types of mail services, but has not been integrated with the automated digital filing system as implemented in SIPANDAI. Research [2] focuses more on simplifying the flow of mail services and the use of village local networks, but has not developed coordination features between village apparatus such as peer-review of mail status available on SIPANDAI. Meanwhile, [30] evaluate the quality of the village service system with the WebQual 4.0 approach and found that the usability and information quality aspects have not been optimal. On the other hand, SIPANDAI has been tested through user trials and shows positive results in all three dimensions of WebQual: usability, information quality, and interaction quality. Based on this comparison, it can be concluded that SIPANDAI shows advantages in terms of system integration, ease of access, security, and user satisfaction compared to six similar systems developed in the previous study.

CONCLUSION

This study proves that the development of the SIPANDAI system with an Agile approach effectively improves village public services through functional features that speed up administration, increase efficiency, and encourage community participation. The Agile method has proven to be appropriate in the development of village government information systems. In the future, it is recommended to integrate with the national population system, routine training for village officials, counseling to the community, and periodic evaluations to ensure the sustainability and adaptability of the system.

However, the limitation of this system is that it has not been widely tested in rural areas that have unstable internet network infrastructure. This is an important consideration for the next development so that the implementation of the system can reach all village conditions evenly and optimally.

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