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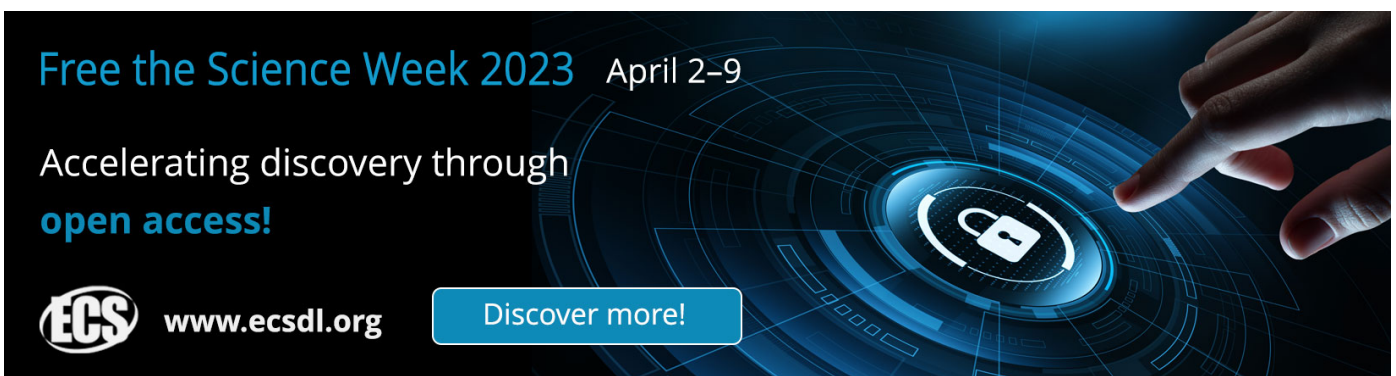
Prototype of Integrated Livestock Recording Application with Animal Identification and Certification System in Kebumen

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Prototype of Integrated Livestock Recording Application with Animal Identification and Certification System in Kebumen

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Abstract. The Department of Agriculture and Food of Kebumen has utilized information technology to register livestock and provide identity cards to livestock with the Livestock Card Database system. Unfortunately, between the Livestock Card Database System and the Recording and Certification System was not integrated, so there is one job carried out by two officers. Data on making livestock cards comes from forms filled out by data officers in the village area from livestock, while data recording comes from recording officers from members of herding group / designated officers. The output of this research is in the form of an Android-based recording application prototype design, which is integrated with the livestock card database system as an identification system, and the recording and certification system as a system for animal certification.

1. Introduction

Based on the Decree of the Minister of Agriculture of the Republic of Indonesia with Number 358 / Kpts / PK.040 / 6/2015, Kebumen Regency has its own PO Kebumen cattle line as a local Kebumen cow. Kebumen Regency is a cattle development center and one of the sources of seedlings for Peranakan Ongole (PO) cattle. The government re-established the Kebumen district as a source of local Indonesian livestock breeds, PO cows, in early 2015 [1].

The Government of the Department of Agriculture and Food (Distapang) of Kebumen Regency has utilized information technology to register livestock and provide identity cards to livestock with the Livestock Card Database System. With this system, Distapang Kebumen Regency can quickly find out the livestock population and household of farmers. The issuance of livestock cards is intended to bring order to the administration of livestock ownership and to improve animal quality control. Kebumen Regency is one of the best cattle breeding areas at the national level, namely for PO cattle. Therefore, the Agriculture and Food Service Office of Kebumen Regency provides a Breeding Certificate (SKLB) for livestock. SKLB will increase the trust and satisfaction of livestock breed users, and will certainly increase the price of livestock. To make SKLB, Distapang uses the help of the SKLB Recording and Printing System.

A recording is an activity related to the recording of individual livestock which shows weight growth, reproductive events, and development. Unfortunately, between the Livestock Card Database System and the SKLB Recording and Printing System is not integrated, so there is one job that is done by two officers, namely livestock data collection. Data on making livestock cards comes from forms filled out by data officers in the village area from livestock, while data recording comes from



recording officers from members of the herding group / designated officers. This requires prototype recording applications based on Android, which is integrated with the Livestock Card Database System as an Identification System, and the Recording and Printing System of SKLB as a System for Animal Certification.

2. Literature Study and Hypothesis Development

Implementation of agricultural / animal husbandry electronic services is very important to get support from the government. Nowadays, e-Government specifically appears in various paradigms, such as e-Procurement, e-Voting, etc.[4] has proposed a new paradigm in e-Government, called e-Livestock, and is a major concern in their research. They mentioned that the e-Government System can support the government in serving the community.

The Department of Agriculture and Food of Kebumen Regency has utilized e-Government in identifying livestock and breeder families in Kebumen Regency. Subagyo in his research designed the Livestock Card Information System. Livestock Card Information System is a system used to collect large livestock, print livestock cards, and provide information on livestock populations and breeders' families in Kebumen Regency. This information system is web-based, so it can be accessed from many users' connected computers[5].

3. Research Method

The research method that will be used in this research is the design science research (DSR) method. The reason for using this method is that design research is essential for success in scientific disciplines that are oriented towards creating artifacts. Design research is a research paradigm where a designer answers questions relevant to human problems through the creation of innovative artifacts[6]. Artifacts that are designed are useful and fundamental in understanding the problem.

Based on the methodology and framework of Design Science Research and Methodology (DSRM) proposed and developed [7], then in this study carried out with six activities/stages namely identification of problems and motivations, the definition of goals for solutions, design and development, demonstration, evaluation, and communication[8]. The model of the Design Science Research Methodology Process Model is explained as shown in figure 1.

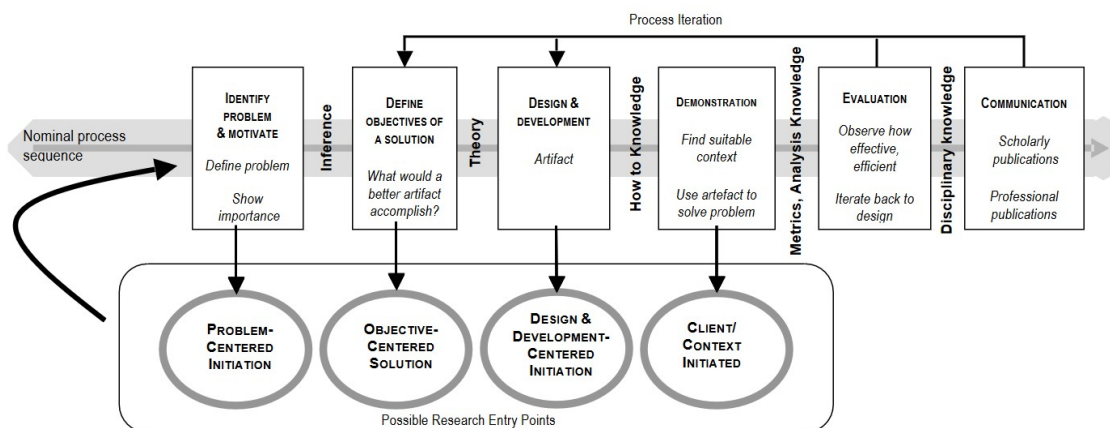


Figure 1. Design Science Research Methodology Process Model [8]

3.1. Identify Problem and Motivate

The first step is to identify all the problems in the District Agriculture and Food Service. At this stage, the problem definition will also be carried out to further develop a model that can provide a comprehensive solution.

The problem identification process is carried out by collecting data at the Research Site. Data collection is done in 2 ways, namely:

A. Observation

Researchers position themselves as observers and participate so that observations are made by direct observation in the Department of Agriculture and Food Kebumen Regency.

B. Interview

An Interview is a form of technique in collecting data through question and answer. Question and answer were conducted with the staff of the Animal Husbandry and Animal Health Department of Agriculture and Food. Interviews were also conducted with the Chairperson of PERPOKEP and the coordinator of Farmer Groups in 3 Districts, namely Puring, Petanahan, and Klirong. The interview method is used to obtain information about events that researchers cannot personally observe, whether they happened in the past or because it is not possible to be present at the scene.

3.2. Define Objectives of Solution

To find a solution to the problems that can be obtained, first define the problem by conducting an interview and discussion activity with staff in the field of Animal Husbandry and Animal Health, Agriculture and Food. The results of this discussion are in the form of conclusions to explain the purpose of the solution, the definition of the problem, as well as knowledge of what is possible and feasible to be used as a solution.

3.3. Design and Development

After getting the solution of the problem, the researchers then created an artifact design in the form of an enterprise architecture model (AE). The AE model created includes business architecture, data architecture, application architecture, and technology architecture. Explanation at each level of enterprise architecture is as follows.

a. Business architecture

The design phase of business architecture will begin from studying existing business patterns. Study all the actors involved then study the processes that occur at the Department of Animal Husbandry and Food (Distapang) Animal Husbandry and Animal Health Kebumen District. Then study the process that occurs in Farmers who are members of the Livestock Farmers Group (KTT) and collected in PERPOKEP. It also studies the relationships and activities carried out between PERPOKEP, Breeders / Summits, and Distapang. After getting the information then formulate it into business architecture.

b. Data architecture

After studying the business patterns then data collection will be carried out. The data requirements in question are the data that will be needed in making the application. The data is adjusted to the business architecture. In determining the data, consideration will be given to the extent to which the data is considered important for use in the application so that it can support the business architecture created.

c. Application Architecture

The next step is creating the application architecture. The application architecture will contain features that have been formulated in the previous stages. The application architecture will accommodate the data architecture that has been created. The application architecture will contain modules that are useful for processing data that supports business processes.

d. Technology Architecture

In the next stage which is the making of technological architecture. In making technology architecture, it will consider the current technology and adapt it to the conditions in the field. It is hoped that the use of technology will encourage and facilitate users in utilizing information technology so that there will be harmony between technology and business processes that exist today.

After designing the AE model, application prototypes will then be developed. The prototype development application will be adjusted to the model that has been made. The prototype design was made in the form of a mockup using Adobe XD software.

3.4. Demonstration

After developing the prototype paper in the form of a mockup, the results of the design were displayed to the staff of Animal Husbandry and Animal Health and some Animal Group Coordinators. This stage is done to provide knowledge to users what application features are developed. At this stage, it is explained how the features of the application are run and who is accessing them. At this stage also explained how a process can help a problem solve.

3.5. Evaluation

At the evaluation stage, potential users are asked to fill out questionnaires related to the models and prototypes that have been developed. Calculation of results from the questionnaire will use a Likert scale. Likert scale is a measurement method used to measure the attitudes, opinions and perceptions of a person or group of people about social phenomena (Sugiyono, 2012).

The Likert scale calculation starts with determining the answer score. In this study will use the answer score of five consisting of strongly agree (SS), agree (S), disagree (KS), disagree (TS), and strongly disagree (STS). After the survey results of the respondents are collected, then the attitude of the respondents will be known so that the tendency of the users towards positive or negative will be known. Then prospective users are asked to provide feedback, responses, and input regarding the models and prototypes that have been developed.

3.6. Communication

Manuscripts of research related to the problems and solutions above, then documented and made a report as a result of scientific research and can then be developed in the Department of Agriculture and Food and Animal Husbandry in the District of Kebumen.

4. Results and Discussion

According to the staff of the Processing, Marketing and Feed Section of the Agriculture and Food Office of Kebumen Regency, the problem faced was the rapid mutation of livestock in Kebumen district, so that the livestock card had just been given to the owner breeders, the livestock concerned had mutated. This is because the identification is carried out by recording the breeders and their livestock by recording on the form, then the form is sent to the Agriculture and Food Service as a group. After the form is in the Department of Agriculture and Food, it still has to wait for the livestock card officer to input the data into the system and then print the livestock card.

4.1. Identify Problem and Motivate

This stage produces a list of system requirements obtained from the problems faced by farmers, groups, and the government, in this case, the Department of Agriculture and Food (Distapang) Kebumen Regency. The collection of problems was carried out by interviews with several parties, namely the Head of Animal Husbandry and Animal Health, Staff of Processing, Marketing and Feed Section in the Agriculture and Food Service where the Livestock Card Information System is used.

From the interviews it was found that they wanted a system/application that could help group officers identify and record livestock. Besides, the application is integrated with the Livestock Card Information system and the SKLB Printing System in the Kebumen District Agriculture and Food Service.

There are 6 (six) related actors, namely Breeders, Livestock Card Officers, Livestock Certification Officers, and Office Executives, Data Collection Officers, and Recording Officers. Use case diagram showing the Actor with the current process is shown in Figure 1. We can know from Figure 1 that there are processes that are carried out several times and are separated from each other. This happens because the two users use a different application, which should be integrated. Then Use Case Data Collection (Paper Based) conducted by the data collection officer and recording officer can also be

made an application whose data can be accessed directly by the Livestock Card Officer and Certification Officer. In Figure 2 there is also a Use Case Data Input Last Livestock Recording can also be combined with the Recording Data conducted by the Recording Officer if there is an integrated application. These make the livestock card or the certificate that is made when it will be given to breeders often occurs cattle has mutated due to the long time of making the card.

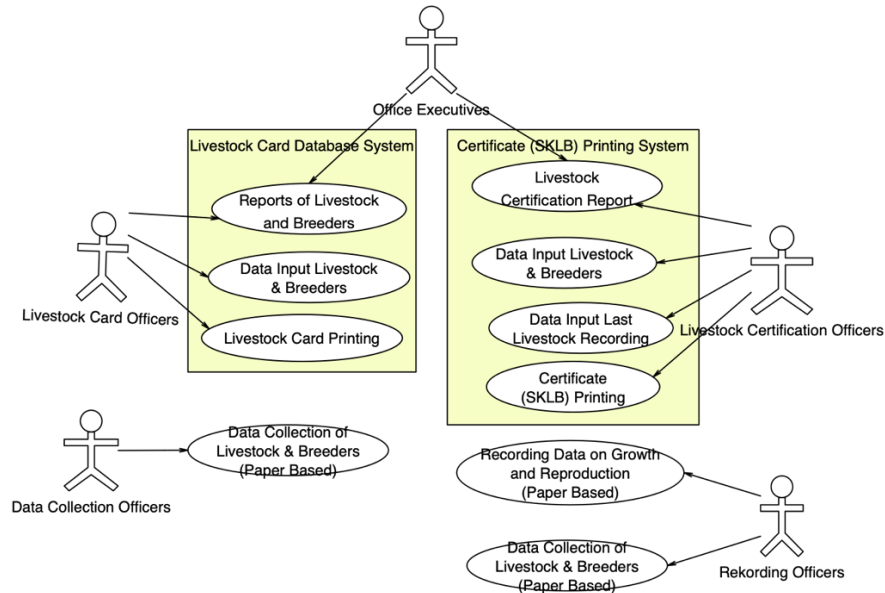


Figure 2. Use Case Diagram Existing

From Figure 2 we can also find out if the Livestock Card Officer cannot know when the mutation of the livestock occurs. The Livestock Card Officer will know when the data collection is done by the Data Collection Officer or the Recording Officer. So, the leaders of the Agriculture and Food Services could not find out the sources of the existing seedlings on the farm immediately. This is in accordance with what was conveyed by the Head of Animal Husbandry and Animal Health at the Kebumen Agriculture and Food Service. From the reports obtained, the Head of Service and Head of Animal Husbandry and Health have not received performance information of livestock that needed by breeders such as Calving Interval (CI), Calving Rate (CR), and Service per Conception (S / C). In addition, according to the data collection officer, they have difficulty persuading farmers to register their livestock because they feel that without a livestock card, they can still sell their livestock. And they are also worried that they will be taxed. A summary of it all, the problems that occur are shown in Table 1.

Table 1. Summary of Problems Identification

Number	Activity	Identification Of Problems
1	Livestock Card Making	<ul style="list-style-type: none"> - Livestock Card Making is still done in groups for each region so that the livestock card has not / cannot be immediately given to farmers. (P1) - The livestock/clerk card officer has difficulty persuading the farmer to register his livestock. (P2)
2	Livestock Recording and Certificate Making	<ul style="list-style-type: none"> - The SKLB Making System is not integrated with the Livestock Card Making System. (P3) - Head of Service and Head of Animal Husbandry and Health have not received performance information cannot easily get performance information from farms such as Service Per Conception (S/C), Calving Interval (CI), and Calving Rate (CR) easily. (P4)

4.2. Define Objectives of Solution

This stage is the stage to provide a solution, from each of the defined problems. At this stage, interviews and discussions were conducted with staff from the Animal Husbandry and Animal Health sector. Besides, there were also discussions with several coordinators of Farmer Groups. From the results of the discussion carried out, the proposed solution is obtained. The proposed solution is to create an online system for Data Collection Officers in villages to be able to input/register directly livestock and breeders in their respective areas, so that livestock card officers only need to print livestock cards, recording officers can input data recording online, and certification officers can print the certificate directly, and the system can display S/C, CI, and CR information.

To make farmers interested in registering their livestock, applications need to be made that can sell their livestock online. And when these are integrated, livestock distribution and mutation information will be immediately obtained.

In this study there are 4 (four) similar software / applications which are used as material for consideration and comparison in making architectural models. The four software that are used as comparison are Online Ruminant Software (Director General of Animal Husbandry Ministry), Animal Husbandry Investigation (Grati Beef Cattle Research Station), Dairy Cow Breeding Software (Center for Superior Animal Breeding and Animal Feed Forage (BBPTUHPT) Baturraden), Livestock Database Software (Superior Livestock Breeding Centers (BPTU) Sembawa).

From the existing problems and the results of the discussion, the proposed solutions are:

1. Integrate the livestock card making system with the certificate printing system, so that the livestock data inputted by the livestock card officer can be read by the certification officer. Vice versa, the data entered by the certification officer can be read by the livestock card officer. (P1)
2. Creating a mobile application that can be used by data collection officers in the field to collect data from farmers and livestock. And the data entered by the data collection officer can be directly accessed by the livestock card officer or the certification officer. (P1)
3. Creating a mobile application that can be used by recording staff to record both growth and reproduction of livestock. (P3)
4. Creating a mobile application that can be used to buy and sell livestock by farmers with the general public. So, only farmers who register their livestock can sell cattle online in the hope that it will make farmers interested in registering their livestock. (P2)
5. Creating a mobile application that can be accessed by the head of the Agriculture and Food Service to see information on the availability of livestock and livestock germs, livestock performance, and livestock distribution. (P4)

4.3. Design and Development

At this stage, the requirements of the prototype application will be determined based on the identification of the problem and the determination of the solution that has been done in the previous stage. At this stage, the modeling will be presented using the concept of enterprise architecture by creating business architecture, data architecture, application architecture, and technology architecture.

4.3.1. Business Architecture

In the first stage, the business architecture that will be built will be discussed. Business architecture will discuss business activities that occur in the field, the actors involved in every existing business process and formulated into a business architecture. Grouping into business architecture based on solutions obtained from the stage of determining the object / purpose of the previous solution. The business architecture that will be discussed in this paper is divided into 4 (four) processes. The four processes and the actors involved are shown in table 2.

Table 2. Summary of Business Architecture

Number	Business Architecture	Actor
1	Data Collection of Livestock and Breeders Process	Livestock Card Officers, Livestock Certification Officers, Data Collection Officers, Head of

		Service/Office Executive, Breeders
2	Recording Data Process	Livestock Certification Officers, Recording Officers, Breeders
3	Lost and Death Reporting	Breeders
4	Livestocks Distribution	Breeders, General Public, Livestock Card Officers, Office Executive

1. Data Collection of Livestock and Breeders Process

In this business architecture the data collection officer can register the breeders, livestock owners (rowdy) in their area who do not / have not registered actively, along with the livestock they have. For the validity of the breeder / rowing ID card data, it can be integrated with a webservice owned by the Office of Population and Civil Registration. In this process the recording officer can enter the data on the development of livestock both body weight and body size of the livestock. With this the Livestock Card Officer and SKLB Officer can directly print the Livestock Card and SKLB for qualified livestock. In addition, Kasie, Kabid, and the Head of Department can monitor the Livestock Population, Farmer Households in each region, and also know the S / C, CI, and CR values for each area / herd.

2. Recording Data Process

The recording officer will get a notification in the form of the time / schedule suggested for recording in a certain area. Then the recording officer records the results of the recording. Recording data recorded is livestock development data both body weight and body size of livestock such as Weighing Date, Height (TB), Body Length (PB), Chest Circumference (LD), Hip Height (TPg), Scrotum Circle (LS). In this process reproductive recording is also carried out starting from the observation of lust, marriage, pregnancy check up to the birth of livestock.

3. Lost and Death Reporting

The loss reporting process is carried out by the farmer if he loses the livestock he has. Reporting is made to the Department of Agriculture and Food by including evidence of loss reports from the police along with other required conditions. So that the department can immediately take care of insurance claims from livestock.

4. Livestocks Distribution

In the business architecture, the distribution and marketing process of livestock contains information about the parent animals that are ready for sale. In this process the breeder can actively offer and register livestock that are owned and ready for sale. And of course the data collection officer can monitor livestock data, animal mutations in their respective areas. Figure 3 shows the use case of the whole prototype process will be developed.

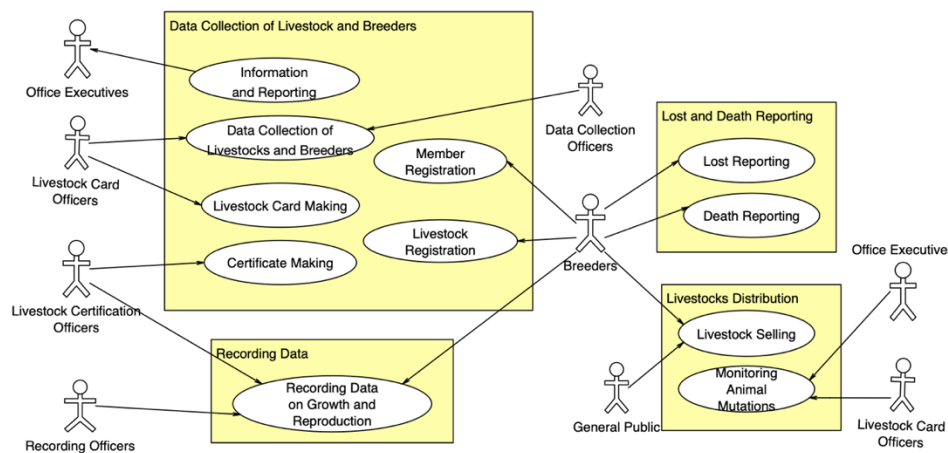


Figure 3. Use Case Diagram of Prototype

4.3.2. Data Architecture

Data architecture is a supporting component of the business architecture that has been explained previously in the concept of enterprise architecture. The data architecture that will be discussed is the need for any data to accommodate business processes that have been described in the business architecture. In determining the data requirements by looking at the objects and processes on the farm. Data needed on this system are:

1. Users, contains user identity data both breeders, and the general public
2. Livestock, contains data on livestock identity and their characteristics
3. Livestock ownership, Contains data on ownership of livestock and breeder keepers
4. Growth, Contains data on body weight and body weight measurements such as chest circumference, hump height, hip circumference.
5. Mating, contains data on livestock breeding events
6. Pregnancy Check, contains data on pregnancy inspection events
7. Birth, contains data on the incidence of livestock births
8. Sales, contains livestock sales data
9. Lost, contains data on livestock loss
10. Death, contains livestock mortality data
11. Region, contains data on village and sub-district areas
12. Certificate, contains certificate or seed eligibility data

4.3.3. Application Architecture

In the application, architecture will contain supporting application features of the data architecture that have been determined in the previous section. Application architecture contains all the supporting application features of the data architecture where the features are made based on the needs that exist to facilitate being able to represent in the form of applications. The application was made in two platforms, namely for the mobile and web platforms.

The mobile application platform is needed for users in the field such as farmers, data collection officers, recording officers. Besides, mobile applications are needed when in the field, because to anticipate internet signals that are difficult to obtain in certain areas. If an internet signal is difficult to obtain during recording or cattle data collection in the field, then the data will be temporarily stored on smartphone storage. After the officer gets enough signal, the synchronization process is carried out in the background of the application.

The web application platform is used for the Agriculture and Food Service where the internet connection is quite smooth. Officers in the Service are not a problem if using a PC / Laptop to access web applications through a browser. Also, in the making of Livestock Cards and SKLB Certificates beforehand, the application platform is used in the web form and accessed through a browser.

4.3.4. Technology Architecture

At the last stage in the concept of enterprise architecture for the Electronic Animal Husbandry model in Kebumen Regency is technology architecture. The technology used to run applications uses cloud technology. To run a web application a web server and database server are needed to store the database. Then the web application is made a web service that can be used by mobile applications or other applications to communicate.

4.4. Demonstration

The demonstration stage is carried out by presenting a model to the staff of the Agriculture and Food Service. This stage is carried out to facilitate the Department of Agriculture and Food to implement a prototype that has been developed.

Due to the difficulty of gathering all parties in one place, the demonstration was carried out with interviews and discussions with several parties. Table 3 is some parties conducted interviews and discussions.

Table 3. Demonstration Stages

Number	Date and Time	Party	Place
1	Tuesday, August 13, 2019	• Livestock Card Officers	Kebumen Regency's Agriculture and Food Service Office
2	Tuesday, August 20, 2019	• Processing, Marketing and Feed Section Staff	Kebumen Distapang EXPO Stand, Kebumen District Square
3	Wednesday, August 21, 2019	• Head of Animal Husbandry and Animal Health	Kebumen Regency's Agriculture and Food Service Office

4.5. Evaluation

Evaluation is done by giving questionnaires. Then potential users are asked to provide feedback and input. The demonstration was carried out by conducting interviews and discussions with several staff, and heads of fields from the Animal Husbandry and Animal Health Division of the Kebumen District Agriculture and Food Office. The questionnaire contains the question of whether the prototype of a recording application that has been developed can solve the M1-M4 problem as identified in table 4. The answer to the question consists of 5 choices, namely 1. Strongly Disagree (STS), 2. Disagree (TS), 3. Less Agree (KS), 4. Agree (S), 5. Strongly Agree (SS).

Table 4. Results of Questionnaire Answers

Number	Question	Answer Count				
		STS	TS	KS	S	SS
1	The prototype can help so that the making of Animal Cards is not done in groups for each region so that livestock cards can be immediately given to farmers	0	0	0	6	3
2	The prototype can help livestock card officers/assessors to invite farmers to register their animals	0	0	0	7	2
3	The prototype integrates SKLB Making with Livestock Card Manufacturing	0	0	0	5	5
4	The prototype can help the Kebumen Agriculture and Food Service to easily obtain seed availability and performance information from farms such as S / C, CI, and CR	0	0	0	6	3

From table 4 it can be seen that the prototype developed for all problem solutions was agreed by the respondents. In addition to providing assessment through questionnaires, several respondents also gave responses. Table 5 shows some responses given by several respondents/stakeholders from various parties.

Table 5. Responses from several stakeholders

Number	Party	Respons
1	Head of Animal Husbandry and Animal Health	This application can help the office to get data on the availability of seeds/livestock in Kebumen district.
2	Livestock Card Officer	This application will facilitate the input of livestock data and distribution of livestock cards immediately, not having to wait for forms to be delivered by the data collection officer to the service. Also, certificate-making officers (SKLB) no longer need to input livestock data or record data.
3	Processing, Marketing and Feed Section Staff	This application can help the service to provide feed formulation recommendations to livestock. However, about livestock sales, it is anticipated to deal with middlemen who do not like it.

From some of the responses in Table 5 it can be concluded that in general stakeholders provide a positive assessment.

4.6. Communication

This stage is the final stage of the study where the manuscripts relating to problems and solutions are documented and made into journals as a result of scientific research and then published.

5. Conclusions and Suggestions

5.1. Conclusions

The recording application prototype which is integrated with the farmer identification and certification system has been developed with the design research methodology. Development is made with the concept of enterprise architecture, namely by making business architecture, data architecture, information/application architecture, and technology architecture. The results of the evaluation are prototypes developed for all problem solutions that have been agreed upon by the user

5.2. Suggestions

- a. The prototype that has been made should be implemented on a real system.
- b. Need to do further testing, for example by testing user satisfaction.

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