

The Design of Chicken Growth Monitoring System for Broiler Farm Partnership

Hindriyanto Dwi Purnomo, Ramos Somya, and Awanda Ardanewari

Abstract— Broiler supplies most of the proteins need for Indonesian. The continuous raise of demand of chicken meat encourages poultry companies to improve its productivity. A factor that plays important role to increase poultry farm productivity is the monitoring of chicken growth. The most common practices to growth chicken in broiler industries in Indonesia are partnership. In this schema, the industries rely on the poultry field instructor staff to monitor the chicken growth. The poultry field instructor staffs go to the chicken cage once or twice a week, therefore, it is difficult to get accurate data on daily based. The chicken growth monitoring system proposed in this study aims to help the industries to monitor chicken growth daily to support their productivity.

Keywords—broiler, poultry, monitoring system, partnership

I. INTRODUCTION

BROILER industries have important role in fulfilling the need of protein for Indonesian. Around 53% of animal protein need for Indonesian is fulfilled with chicken meat [1]. Compared with the other livestock industries, the needs for chicken meat have been self-sufficient by the nation [2]. Broiler highly demanded by the poultry farm industry because it has many advantages, such as: short time of chicken growth, high turnover rate [3] as well as high market demand of chicken meat. According to Rasyaf [4], broiler production standard is based on the weight gain, feed intake and feed conversion. Furthermore, Tobias [5] suggests three important things that need to be considered in broiler chicken farming; (1) feed and water, (2) medicine, vitamins, sanitation and vaccination and 3) cage.

In the recent years, broiler industries have been integrated from upstream to downstream, forming a solid supply chain. The most common practices to run broiler industries in Indonesia are partnership schema. It is characterized by big or medium company that involves breeder as their partner [3].

In the partnership schema, high number of partners (farmers and breeders) will lead to high difficulty of

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monitoring the growth of the chickens in the partner level. On the other hand, the growth of the chickens needs to be observed intensively because of its short period of growth and it easily gets diseases. Poor monitoring system will reduce the productivity and increase its mortality rate.

A common practice for Indonesian broiler industries in monitoring the growth of their chickens in the partner side is by send extension worker to monitor and providing assistance on a regular basis. This practice consume large resources and time, especially when the breeder partners distributed in various areas. The reporting mechanism is often done manually, by collecting the monitoring sheet at the end of the growing period. This leads to slow data processing and wrong handling when extreme cases happen (such as fast spread of disease). In additional, the conventional reporting mechanism also resist to the fraud committed by the breeder partner.

This research discussed a novel design of broiler growth monitoring system using short message service and mobile application in the partner side. Short message service and mobile application are selected because they have been used intensively by breeder partners in Indonesia.

II. LITERATURE REVIEW

The use information and communication technology for farm monitoring system are not widely practiced. Several published literature discussed the used of information and communication technology for monitoring cattle such as horses, cows, sheep and pigs. Kwong et al [6] implement wireless sensor network to transmit the condition of cows. Clapham [7] investigate the use of acoustic sensors to monitor cow's behavior. Haroki and Takaaki [8] apply GPS technology to observe the grazing habit of cows. Mayer [9] uses GSM to transmit cow's condition.

Monitoring system in poultry farm often focuses on its environment condition such as cage sanitation, air in the cage as well as particles in the air in the cage [10]. The distribution of chicken in the cage can also be used to monitor the water consumption [11] as well as the heat distribution, especially in the early stage of chicken growth.

Broiler is a potential commodity in Indonesia and its demand continuously increases. Broiler growth very fast, have small feed conversion and ready to be harvested in a relatively short period [3]. The total population of broiler in Indonesia tends to increase in the last few years. However, the chicken meat consumption rate in Indonesia is lower compared to the chicken meat consumption rate in other South East Asian countries [12]. In order to fulfill the growing need of chicken meat, poultry farms should increase their productivity.

Intensive monitoring the growth of chicken becomes an important role to increase poultry farm productivity.

TABLE I
POPULATION AND PRODUCTION OF BROILER
*DEPARTMENT OF LIVESTOCK, INDONESIA [11]

Tahun	Broiler Population	Production of broiler meat (ton)
2009	1,026,378,580	1,101,765
2010	986,871,712	1,214,339
2011	1,177,990,869	1,337,911
2012	1,244,402,016	1,400,470
2013	1,355,288,419	1,479,811

III. THE DESIGN OF BROILER GROWTH MONITORING SYSTEM

Partnership is a common poultry farm industry practice in Indonesian. In the partnership schema, there are four actors that relate one another; a poultry company, breeders partner, cage boy and poultry field instructor staff. The relation is illustrated in figure 1.

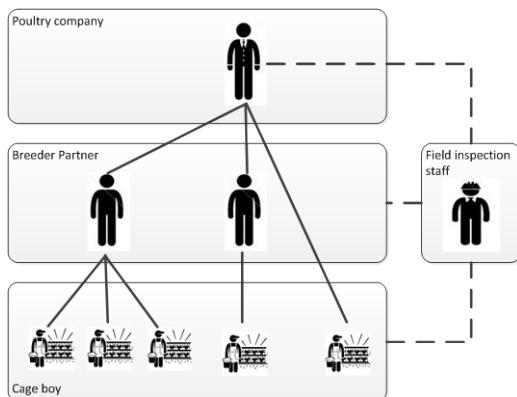


Fig. 1 The partnership schema

A poultry company cooperates with breeder as their partners. A breeder partner may have one or several cage boys or he himself becomes the cage boy. Poultry Company responsible to provide day old chicken, chicken food, medicine, vaccinates and sells the chicken at the harvest time. Breeders partner has responsibilities to provide cage and grow the chicken, while the cage boy handle the daily operation in the farm, such as feeding the chicken, monitoring the chicken growth and controlling the cage condition. Poultry field instructor staff has the responsibility to monitor the growth of the chicken as well as to provide guidance to the breeders partner and cage boy.

The chicken growth monitoring system has two purposes, to monitor the growth of chicken and to monitor the performance of breeder partners. The chicken growth is observed based on its death rate and its food conversion ratio. The chicken death rate and its conversion ratio is entered to the system by the cage boys. The breeder partner performance is evaluated based on the average chicken death rate and conversion ratio for several period of growth.

The system architecture for broiler growth monitoring

system is given in figure 2. The mobile front-end system is deployed on mobile devices that are embedded by GSM/GPRS and internet connectivity. This front-end are used to enter the chicken growth data from the partners side. The web based application is another front end for administrative work and to monitor the growth of the chicken based on the data given by the partner and. The back-end system consists of data receiver and database system.

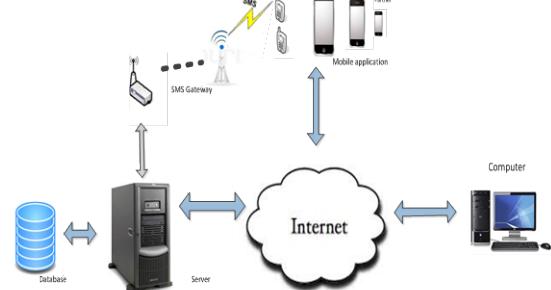


Fig. 2 The system architecture of Broiler Growth Monitoring System

The logical architecture of Broiler Growth Monitoring System is given in figure 3. The logical architecture divided in to presentation layer, application layer and data layer. The presentation layer consists of web based interface and mobile interface. The application layer consists of two main functions, administration task and data processing of chicken growth. The data layer consists of relational database of the system.

The Broiler Growth Monitoring System consists of two main modules, the data collection module and the monitoring module. The data collection module is used to collect data regarding the growth of chicken. There are two actors involved in this module, the cage boy and the poultry field instructor staff. The cage boy send various date related to the chicken growth; chicken age, chicken type, chicken weight, the amount of food given to the chicken in a day, the number of chicken that death in a day as well as reporting the air cycle in the cage and chicken vaccination. The poultry field instructor staff can review the data and then evaluate the growth of the chicken.

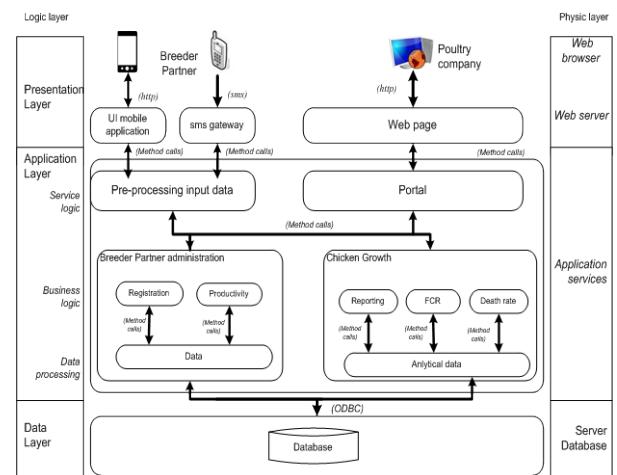


Fig. 3 The logical architecture of Broiler Growth Monitoring System

The cage boy sends the information of chicken growth on daily bases using the mobile application or via short message services. Short message service is chosen because the chicken cage is often located in remote area which is not covered by internet services. However, most of the locations are covered by GSM signal.

The monitoring module is used to monitor the growth of chicken based on the data entered by the cage boy. The parties that could monitor the growth of the chicken are breeder partner, poultry field instructor staff and the poultry company. In addition, the administrator is required to maintain such data. The breeder partner can monitor the data entered by his cage boy(s). The poultry field instructor staff can send report regarding the condition of the cage, the entry and the exit of chicken. The poultry company can access all the data entered by cage boys and poultry field instructor staff as well as registered new breeder partners.

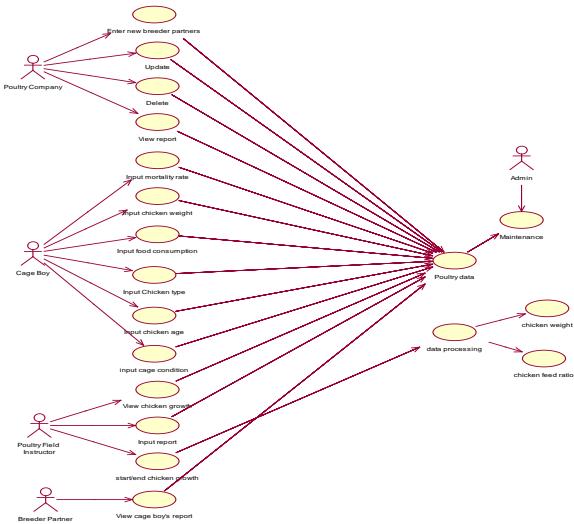


Fig. 4 Use Case Diagram for the chicken growth monitoring system

IV. CONCLUSION

A design of chicken growth monitoring system is proposed in this research. The system aims to help poultry industry obtain the daily growth data of their chicken. The system consists of two main parts, the data collection module and monitoring module. The data collection system facilitates the short message service and mobile application. Mobile application is selected because many breeder partners have used mobile device intensively. However, because the chicken cages are mostly located in remote areas, the areas are mostly not covered with data network; therefore it is not effective to used only mobile application. For this reason, short message service is selected to solve the drawback of mobile application.

The system aims to help Poultry Company to monitor the chicken growth of their breeder partner. The system substitutes the role of poultry field instructor staff to collect data regarding the chicken growth. It is expected that the system can provide more reliable data because the data is entered on daily based.

This research will be continued by implementing the system the poultry company. There are two issues that become the main concern in the implementation phase; first, the commitment of the poultry company and second, the dedication of cage boy and breeder partner to use the system. The two issues significantly influence the success implementation of the system.

In the future, the research can be extended in several ways, such as add the environment condition (air circulation, temperature, etc) in the monitoring module in order to obtain more comprehensive view of the chicken growth. Implement data mining to dig hidden information regarding the chicken growth, such as early detection of disease spread and abnormality in feed conversion ratio.

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REFERENCES

- [1] K. Virgianti, "Wamen Pertanian: Daging Ayam Penuhi 53 Persen Kebutuhan Protein Hewani Masyarakat", [http://satuharapan.com/index.php?id=109&tx_ttnews\[tt_news\]=5515&cHash=1](http://satuharapan.com/index.php?id=109&tx_ttnews[tt_news]=5515&cHash=1), accessed Oct 2, 2013.
- [2] C. Talib, I. Inoune, A. Bamuallim, 2007, "Restrukturisasi peternakan di Indonesia, Analis Kebijakan Pertanian", 5 (1), 1-14.
- [3] M.L., Maulana, 2008, "Analisis Pendapatan Peternak Ayam Ras Pedaging Pola Kemitraan Inti-Plasma (Studi Kasus Peternak Plasma dari Tunas Mekar Farm di Kecamatan Nanggung Kabupaten Bogor)", Institute Pertanian Bogor, Undergraduate Thesis.
- [4] M. Rasyaf, 2004, "Beternak Ayam Pedaging". Penebar Swadaya, Jakarta
- [5] V. Tobias, 2002, "Beternak ayam broiler bebas antibiotik: murah dan bebas residu", Penebar swadaya, Jakarta.
- [6] K.H., Kwong., T.T. Wu., H.G. Goh., Sasloglou., B. Stephen., I. Glover., C. Shen., W. Du., C. Michie., Andonovic, I., 2012, "Practical considerations for wireless sensor networks in cattle monitoring applications", Computers and Electronics in Agriculture, 81, 33-44.
- [7] W.M. Clapham., J.M. Fedders., K. Beeman., J.P.S. Neel., 2011, "Acoustic monitoring system to quantify ingestive behavior of free-grazing cattle", Computers and Electronics in Agriculture, 76(1), 96-104.
- [8] M. Hiroaki, N. Takaaki., 2007. "Grazing behavior of cows measured by handheld GPS and bite counter collar: a case of Fazenda Baia Bonita in South Pantanal, Brazil." Japanese Journal of Human Geography 59(1), 30-42.
- [9] K. Mayer., K. Ellis., K. Taylor., 2004. "Cattle health monitoring using wireless sensor networks." In: Proc. of the Second IASTED International Conference on Communication and Computer Networks, Cambridge, Massachusetts, USA.
- [10] J.W. Worley, L.P. Naehler, M. Czarick, B.D. Fairchild, C.W. Ritz, E.I.Barnwell., 2013, "Monitoring of fine particulates downwind of broiler houses- A field study", The Journal of Applied Poultry Research, 22, 351-360.
- [11] M. Czarick, B. Fairchild., 2002, "Monitoring Broiler Distribution Through Water Consumption", Poultry Housing Tips, 15(6),1-5.
- [12] W. Nurhayat., 2013, "Konsumsi Daging Ayam Orang Indonesia di Bawah Malaysia dan Thailand", <http://finance.detik.com/read/2013/10/03/124755/2376663/4/konsumsi-daging-ayam-orang-indonesia-di-bawah-malaysia-dan-thailand>, accessed November 1st, 2013.