

Design and Implementation of Ubiquitous Chicken Farm Management System Using IOS Smart Phone

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ABSTRACT

Recently in Malaysia, there were none agriculture application that are focusing on chicken farming either web-based or mobile-based hence it is amongst the biggest commodity in Malaysia. As a developing country, Malaysia is planning to look into the concept of ubiquitous city and currently planning towards it. By looking at the significant growth of smart phone user and the Internet usage, the ubiquitous city in Malaysia can be realized. The purpose of the paper is to propose a chicken farm management system by applying ubiquitous concept which enables the owner to self control their farm and efficiently track the weight, food, temperature, humidity and the market price of the chicken itself at anytime and anywhere and be able to share the information across the Internet. In order to accomplish this, a ubiquitous environment also must be set up such as RFID, CCTVs and intelligence robotic to collect all the data.

Categories and Subject Descriptors

H.3.4 [System and Software Current awareness system]:
distributed systems, information network, user profile and alert services.

H.3.5 [Online Information Services Commercial services]:
Web-based services, data sharing.

General Terms

Algorithms, Design, Reliability.

Keywords

ubiquitous; mobile application; smart chicken farming.

1. INTRODUCTION

Chicken meat is the most important agricultural commodities in Malaysia. The statistic conducted by the Department of Veterinary Services indicates that the poultry industry had produced 1214.37 million tonnes of meat for the year 2011. As outlined in the 10th Malaysian Economic Plan, the poultry growths are projected to be 9.9% to 1.4mn tonnes between 2015 and 2016. Thus, there should be a very good and systematic farm

management in Malaysia in order to meet the demand. It is necessary to produce high quality livestock chicken, and decrease the mortality rate by the early detection of disease in chickens and to reduce the cost to its minimum by applying smart farming management system. While there is a need for a system that will monitor the progress of chickens from start till the end, chances to make it as on-the-go application is really high. In Malaysia, demand for smart phones is overwhelming. It is reported that from 89.6% who owned hand phones and 12% out of them were using the smart phone in 2011 [1]. Most of the time the users use the internet in their smart phone basically for social networking which contribute to 74.4% whereby the mobile application as for 2011 was only 36.1%. Based on the latest GoMobile Conference 2012, Too Tian Jen (U Mobile Malaysia) stated that by 2012, over 100 million smart phone users will be using more than 1GB per month. That does indicate that the internet usage will become more and more essential for all users.

This paper will describe how the ubiquitous concept can be applied in chicken farming by applying RFID/WSN (Radio Frequency Identification/ Wireless Sensor Network) as the sensor technology to capture the environmental variables such as temperature, humidity, characters and behaviors, ventilations and heating. An intelligent autonomous robotic is designed and built to capture the chicken's excrement in very high quality photo in order to detect any chicken disease and CCTVs are installed in order to capture any misbehaviors and sound that might be produced by the chicken. This paper also will describe on how the data being presented in iOS mobile application by applying a ubiquitous mobile application framework.

2. DESIGN OF UBIQUITOUS CHICKEN FARM MANAGEMENT SYSTEM

2.1 System Structure

The system will be divided into three layers. The first is the physical layer that will consist all the sensors that will capture the environment variables such as temperature, humidity, and the behaviors of the chicken. The CCTVs that are installed in the chicken farm are used to collect the sound made by the chickens and also to observe their behaviors. All the inputs from these sensors and the CCTVs are then push into the second layer which will manage and control all the information retrieved. At this point of view, all the inputs are being kept in the database in a formatted data. Each of the sensors has its own control manager unit and the variables in which will be served as web services. On the application layer part, there will be either in desktop

application, web based application or mobile application.

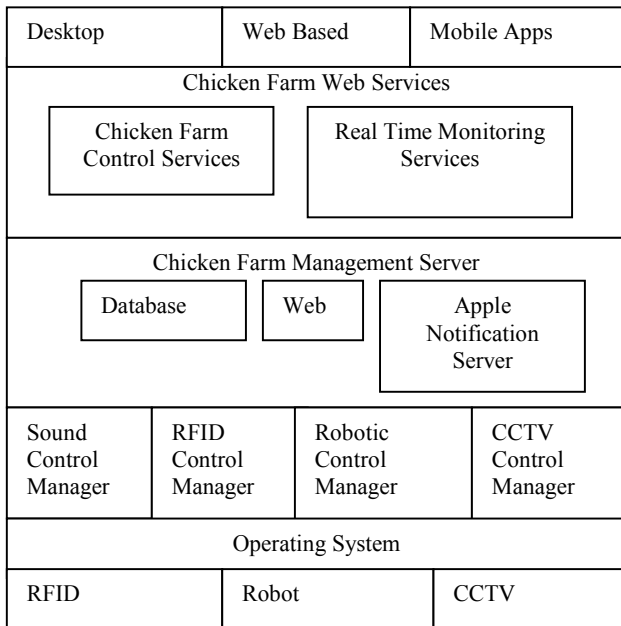


Figure 1. Overview of mySmart Chicken Farm Management System Structure.

2.2 Middle-tier Structure

The objective of having the middle tier structure is to handle all the signals and inputs from the sensors before storing them into the database. The input has been formatted into a standard form of data for the next process. At this level, the control manager should be efficient enough to capture all the data in time and progressively. This is very a important aspect in order to apply the context- awareness concept in ubiquitous term. According to Gregor Schiele, a middle tier structure may provide a great variety of services but it can be classified into three categories such as to provide full transparency in which from the application developer’s perspective, the ultimate middleware system should provide full transparency with respect to the addressed challenge [7]. The second service is configurable automation and the third service would be simplified exposure where configurable automation can no longer achieve satisfying result.

2.3 Sensors Control Manager

The sound control manager is responsible in capturing all the sound made by the chicken. At this point, all the noise is removed by using a specified algorithm and the data is kept in the database as the binary data in which the real sound is kept in a wave format and stored inside the folder. RFID Control Manager is to capture the behaviours of the selected chicken. The RFID tag in installed in certain range of chicken and the movements of the chicken is captured basically at the time when the chicken supposed to eat, drink, sleep and lay eggs. All the movement are recorded using a sophisticated algorithm that can track the pattern. The data is then kept into storage able format. The Robotic Control Manager is not only responsible in capturing the chicken’s excrement in very high quality picture for disease detection, but can also act as the ‘supervisor’ to monitor the overall progress of the chicken. It can play a role as another CCTV for the chicken farm.

2.4 Chicken Farm Management Server

In this section, it has several components such as the database where all the records are kept according to the standard format, the dedicated web server to host the ubiquitous web application and the APN server. The Apple Push Notification server is handled by Apple itself.

2.5 Chicken Farm Web Service

In this section, it will be divided into several applications. There will be a desktop application which will provide more services. It will have a web- based application for easy accessing and controlling the system thru internet and also a mobile application in which its provides on-the-go application.

2.6 Web-based Application

At this level, the MVC (model-view-controller) architecture is applied. The main reason for using MVC is to separate the business logic and application data from the data presented to the user. It is divided into three parts namely, the model in which the business logic relies, the view, which provides a visual presentation of the model and the controller which acts as the back end, processes the user inputs and makes the modifications to the model. By having this framework, it allows reusable components to be applied and reduces development complexity.

2.7 iOS Mobile Application

The Cocoa Touch layer contains the key framework for building the iOS applications. It defines the basic application infrastructure and supports technologies such as multitasking, touch-based input, push notification and many high level system services[10]. In iOS, there are many frameworks that can be built on top of the foundation framework. The foundation framework actually provides all the basic system services for all applications. It provides Objective-C wrappers for the features in the Core Foundation framework which is in C- based. The Core Data Framework whereby to manage the data model of an application. It uses SQLite technology to store and manage data efficiently. The Core Graphics Framework is the simplest and most efficient way to create graphics in iOS since high quality graphics are the most important elements of all iOS applications.

Xcode is the development environment to create, test, debug and tune iOS application. It is a very convenient tool which acts as a wrapper for all of the tools needed to build an app. It has an iOS simulator to test and run the apps or can just be tested directly to the real devices.

According to the Apple Developer Programming Guidelines, Apple Push Notification Service (APN) provides a way to alert users of new information even when the apps is not actively running. It provides text notification, trigger audible alerts on user devices etc. The objective of having this service is to let the users know that they should open the apps to see what is happening. It is a very robust and highly efficient service for propagating information to devices such as iPhone, iPad and iPod. Each device must establish an accredited and encrypted IP connection with the service and receives notification over this persistent connection. The developer or the provider of the apps must connect with the APN through a persistent and secure channel while monitoring incoming data for the user’s apps. When a new data arrives, the providers prepare and send notifications through the channel to the APN which pushes them to the target device.

Basically, it has two major pieces of data inside the notification short message. The device tokens itself and the payload. The

device token is basically a ‘phone number’ which contains information that enables APN’s to locate the device in which the apps have been installed. It is also being used to authenticate the routing of a notification. Whereby the payload is a JSON defined property list that specifies how the user of an application on a device is to be alerted. The provider must install the SSL Certificate and the Key on the server in order to recognize and create a trusted connection between APNs and Provider.

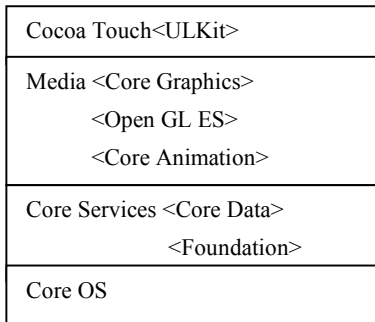


Figure 2. Basic Framework of iOS

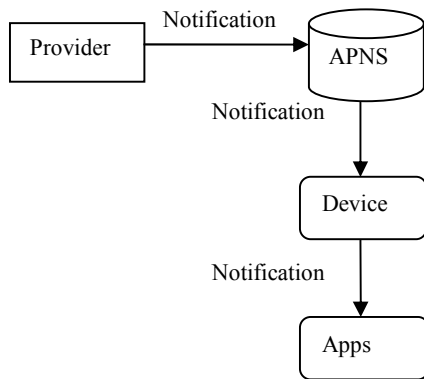


Figure 3. How the APNs work

The SQLite library is an embedded SQL database inside the application. Having this library, there no need for the remote database server process. From the application itself, it can create local database files and manage the tables and records in those files. It is designed to meet the general purpose but yet still optimized to provide the fast access to database records. The XML support is the foundation framework provides a service that can retrieve elements from an XML document.

2.8 mySmart Chicken Farm iOS Mobile Application

The mobile application is designed into three layers, design or presentation layer, the business process layer and the output layer. The design layers will cater all the components that will interact to the user and to capture the event created by the user. Inside the business process layers, it will handle the entire request from the user and send it to the web server. The output layers is where all the requested data being published to the user.

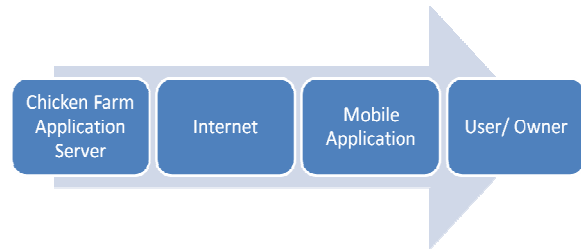


Figure 4. High Level Architecture of mySmart Chicken Farm Management

The design layout is basically designed as simple as possible so that it can fit for the iPhone viewer. It uses the tab-panned functionality to move around from one component to another. There will be no ‘EXIT’ button since it is not allowed under Apple’s regulations. It will have the main interface in which it will have two main buttons; either the user wants to know the current and latest updates of any info regarding the agriculture field or he wants to monitor his farm by clicking the Chicken Farming Control. The numbers of pages used in this mobile app depends of the menu. For this purpose, it only shows the page for “temperature” and the rest uses the same layout.

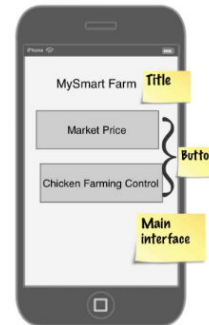


Figure 5. Main Interface of mySmart Chicken Farm Management

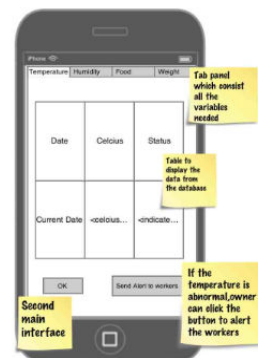


Figure 6. Second Interface of mySmart Chicken Farm Management

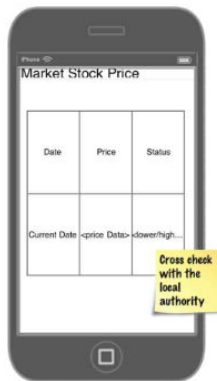


Figure 7. Third Interface of mySmart Chicken Farm Management

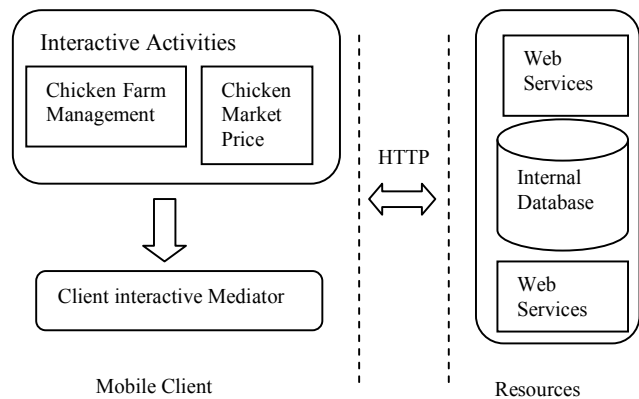


Figure 8. mySmart Chicken Management System: Mobile Application Framework

2.9 Development Environment

Table 1. Compulsory Component To Develop An Application

Implementation	Details	
	Type	Details
iOS Mobile Application	Operating System	Mac OS X Version 10.6.8
	IDE	XCode 4.4
	Programming Language	Objectives-C
	Database	SQLite
	Device/ Mobile	iOS 5/6
Web Based Application	Operating System	Windows 7/ Server
	IDE	Visual Studio 2010
	Programming Language	C++
	Database	SQL Server
	Framework	MVC with Entity Framework

2.10 Mobile Application Framework

The mobile-client framework for Chicken Management System will implement the previous work [11] with some modifications. It will still have several components in order to interact with the user and to get the expected results. The user then will make a queries over the selected item. In previous work [11], instead there is no data is found in individual repository, then the activity will transfer user query to an interactive mediator, the modification is made to direct pass the query to the interactive mediator in which will simultaneously make a connection to the web services. Work [12] claims that an XML and SOAP message generates a larger overhead while exchanging message across the web services. Thus, by adapting work [11], the mediator accommodates the REST-based web services instead of SOAP and just queries only the appropriate web services.

In term of applying the smart interaction between the user and device, one of the key principles in ubiquitous computing concerning the context itself. It should be smart enough to compare the value of each parameters to the standard parameters specified in at most transparent to the user. To accomplish this, several basic steps need to be taken.

Step 1: User need to allow push notification on their devices in order to receive alerts and any notification

Step 2: Connection must be establish.

Step 3: The core framework of the chicken smart management should contains the standard value of each parameters, in this case, it should kept the threshold value for the right temperature, humidity, weight, food, drink of the chicken.

Step 4: The core framework should contains all the time table for the chicken such what time the chicken should eat, drinks etc. By the time is reach, an alert will be sent to the user as acknowledgement and whether or not the any action will be taken. Further steps will be investigated further.

3. CONCLUSION

By having a ubiquitous chicken farm management using smart phones enables the user full control over their farm in more systematic ways. It will then adapt several mobile frameworks to make it more ambience and transparent to the user. The web-application itself must also follows the ubiquitous criteria so that the communication between all the modules is smooth. Provided all the data is correct and being captured well, the proposed system should give all the information and alerts in right time and at anywhere and anytime with the connection is stable. It is expected to produce high quality chicken and reduce cost of loses the chicken by be able to have an early detection disease for chicken and to ensure competitiveness.

4. ACKNOWLEDGMENTS

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