AgriCoord

LUT Group 4

Antti Knutas
Harri Johansson
Li Aoke
Jifeng Xing

Problem

Problem description

Both the problem and the solution for this comes from a Chinese news article where an agricultural problem was reported: Major food spoilage happening because of overproducing a single crop. Normally Chinese banana-producing areas enter the market at different times. In 2009 Yunnan and Guangxi provinces in the southwest of China expanded banana production and entered the market at the same time which in return created surplus.[1] The wholesale price went from 0.96 €/kg to 0.16€/kg throughout the whole country. Similar surplus cases also happened in Hainan provinces in southern China during January 2010 when chili pepper prices descended as low as 0.08 €/kg, which is even lower than the planting cost of 0.1 €/kg.[2] [3] Because it was not profitable to even harvest the crops, massive amounts of chili peppers were just discarded on the roadsides. Also in the Neimengu province 4000 tons of cabbage went to waste. Because common Chinese farmers do not own big enough cold storages, all the surplus crops have to be stored in normal temperatures and they start to spoil rapidly.

Picture 1. Spoiled peppers in China

Considering there are lots of people in the world still suffering from hunger and in this manner tons of food go to waste. The problem is that the farming plans are not coordinated over larger economic areas, just locally. As the agriculture and information technology develops, most of the farmers can get information about farming skills and marketing requirements from further away than was previously possible. In this way farmers know there is a requirement for example bananas and they have enough resources to produce an abundance of crops. But they work independently and are not able to predict the agriculture market, so farmers may lose profit and waste crops. The problem is that a lot of farmers currently react to the market, instead of predicting it.

Solution

Our solution is simulating and evaluating the market requirements and all the farming plans simultaneously in a single economic area. Every farmer is able to submit his farming plan to the system. In order to prevent plant oversupply, the system will evaluate these plans based on the market forecast, and inform the farmers. And if a surplus case similar to Guang Xi happens again, system will warn farmers before planting and suggest a better alternative crop if possible. If crops are planted and the system warns of oversupply then the farmer at least can get more time to consider how to proceed. For example those crops could be given to Red Cross for example, or bartered with neighbors.

---

[1] Fribiz.com. Fox Business. 2009. Online: http://www.foxbusiness.com/story/frbiz-discusses-banana-market/

[2] Wang, Xinhua. Xinhuanet. 2010. Online: http://www.hq.xinhuanet.com/news/2010-01/29/content_18902187.htm

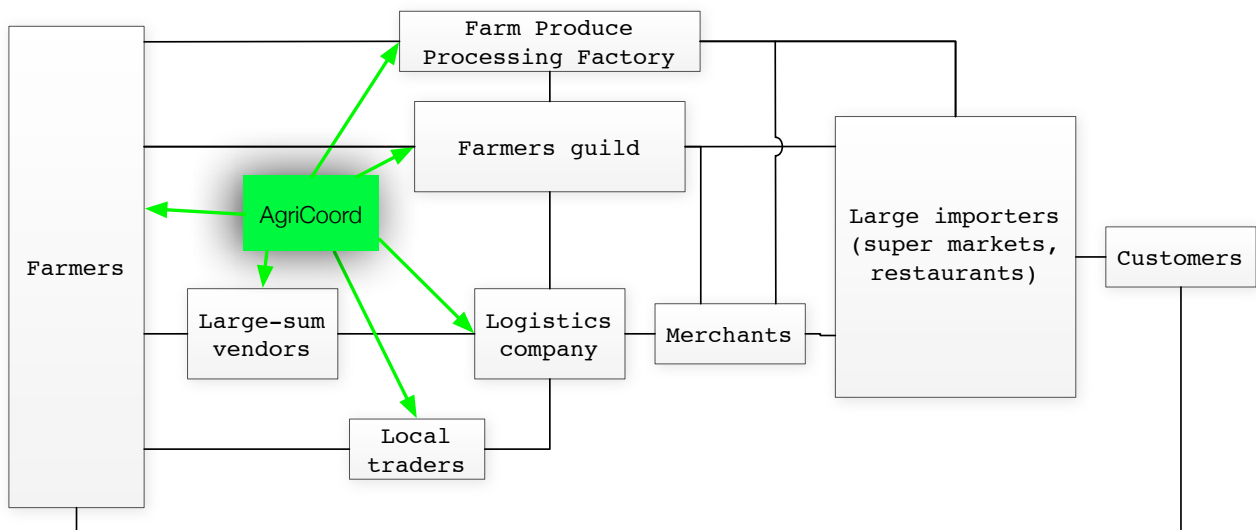[3] World Bank. Commodity Price Data. Annual Averages. 2008.

Chart 1. Planned AgriCoord integration into the trading environment

Software Design

The way how we will implement our solution is to design a software system that provides centralized service of farming planning to an economic area. It helps to connect both the farmers to each other and to larger market traders. It provides planning services to the farmers so that they can switch away from over-farmed crops before the actual planting happens. Market administrators can maintain and set up the system for the farmers, and regular traders can plan their product chain in advance to avoid spoiled goods. The system will not only record farming plans, but it will also attempt to make predictions and graphs based on those, so the users can see what crop prices will be at the end of the season and prepare to the situation.

The software has been designed to use ASP.NET with the C# code behind design methodology as the main programming languages, with the main functionality implemented as web services. The web services are openly available to other developers so that they are able to implement their own interfaces to them. The current design utilizes an ASP.NET web server or a SMS gateway for the interface. Of those two versions the HTML interface allows for richer interaction, and administrative functions. The text message interface is vital, though, since several poorer areas might not have access to Internet but often at least one person per village has the access to a cell phone.

The web front-end and the text message gateway can be replaced with additional interfaces, like a desktop Windows program or a mobile application, but the integral part of the actual server program are a MS SQL server and the ASP.NET web services. Also, the web front-end has been implemented with ASP.NET and runs on the IIS server. The interfaces only display data, but the main two components are responsible for storing, analyzing and sending the data to clients. These are explained more in the architecture section.

Features and Technology

The following list details the most important functionality available in the program.

- Records and presents crop prices
- Accepts input from farmers about planted crops
- Calculates variance to crop prices based on planted crops
- Alerts farmers in case of oversupply situations
- Barter system for unsellable crops
- ASP.NET Web services available for diverse interfaces
- Interactive MSN Maps interaction with Silverlight for determining the economic areas, and the estimated farming areas
- Windows Live universal login

Architecture

The picture 2 below details the data flow and the typical connectivity scenario of the program. Using one of the available interfaces the user makes a request or a command to one of the available web services. When receiving the requests, the web services first authenticate the user, and then use the LINQ translation layer to convert the data queries into SQL. The SQL database has chosen to be an MS SQL database, and it can be run either on a local or a remote computer.
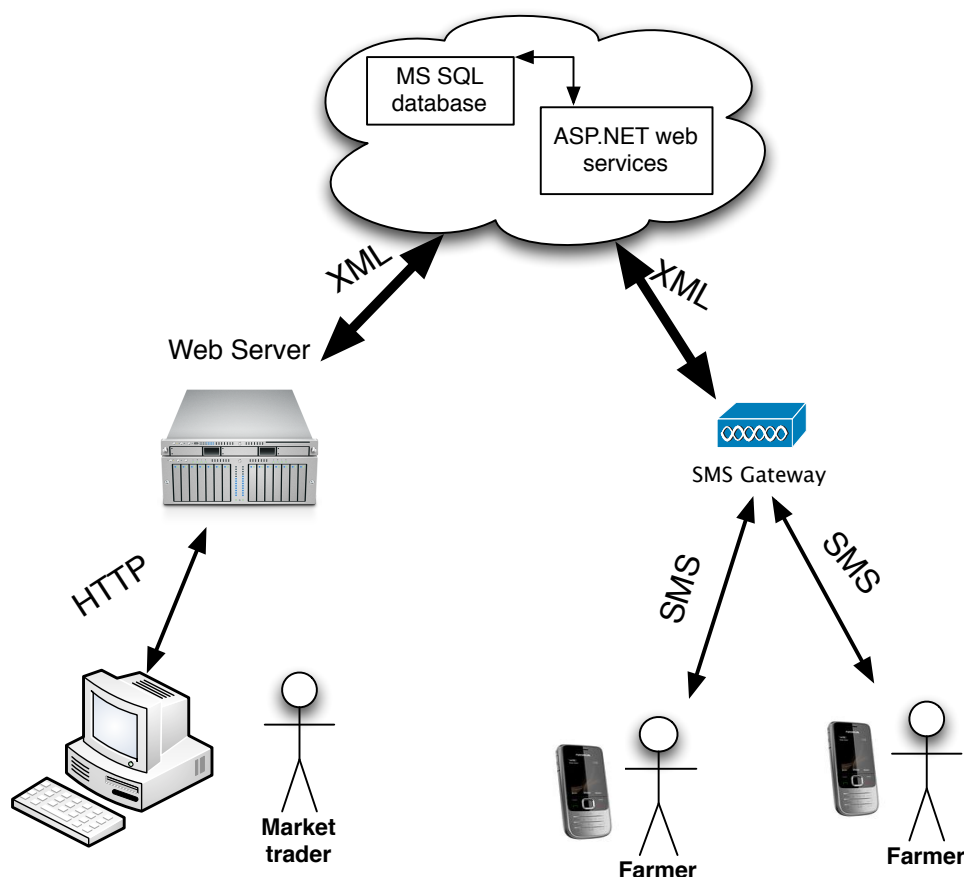

Picture 2. "The big picture"

The flexible architecture where the data storage, data analytics and IO and interfaces are separated from each other in the traditional Model-View-Controller model allow easy extendibility and replacing parts of the logic or view without it affecting other parts of the program.

Use Cases

As mentioned previously, the AgriCoord system has two main groups of users: The farmers, and the traders. The farmers are the main people who benefit from the system, but it can also provide statistics to the traders. The picture below details the main user groups of the system, and the use cases for each group.
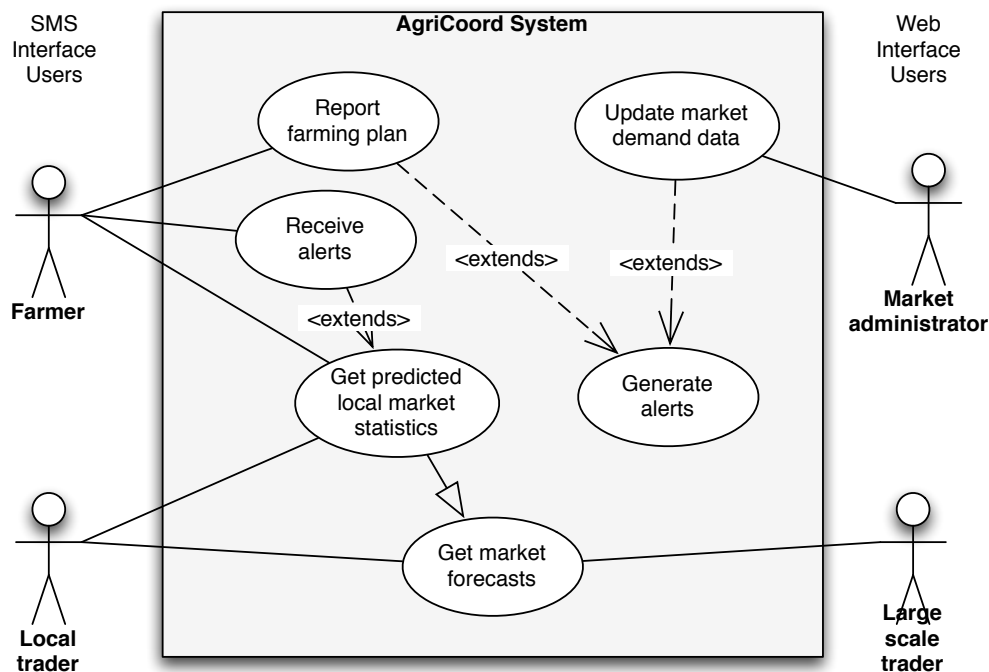
Picture 3. Use cases

The main functionality is aimed for the farmers: They benefit most from the alerts, and the system can provide automatically the most relevant statistics to them depending on the farmer's location. The system is also dependent on the farmers, and the input they provide in the form of farming plans. Receiving a lot of plans is vital to the accurate prediction of the harvesting season's market prices. Other user groups also benefit from the system, though: Local traders can prepare their sales chains to outside the area. Larger scale traders might be persuaded to support the system if the predictions it provides to them provide a competitive advantage.

Example use case scenario: Receiving alert

This scenario assumes as preconditions that the system is functioning and has farming plans and estimated demands available. The trigger of the scenario is another farmer who has reported a farming plan that triggers an alert of dangerously high supply. After the trigger the scenario basically proceeds as follows:

1. The farmer receives an alert into registered mobile phone

2. The farmer checks further details and statistics about the situation with the "get local future market statistics" use case

3. The farmer considers alternative crops, and decides to plant as much of different seeds as possible

4. The farmer eventually reports updated farming plans

The desired goal of receiving an alert is that the farmer is now aware of the situation and is considering planting a type of crop that provides enough subsistence.