Research Studies on the Agricultural and Commercial Field

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***Abstract*—The new Internet of Things (IoT) paradigm is giving to the scientific community the possibility to create integrated environments where information could be exchanged among heterogeneous characteristic networks in an automated way, in order to provide a richer experience to the user and to give specific relevant information regarding the particular environment in which the user is interacting with. Those characteristic are highly valuable for the novel nutrition-based vegetable production and distribution system, in which the multiple benefits of Big Data where used in order to generate a healthy food recommendation to the end user and to feed to the system different analytics to improve the system efficiency. Moreover, the different IoT capabilities, specifically automation and heterogeneous network communication are valuable to improve the information matrix of our project. This paper discusses the different IoT available technologies, their security capabilities and assessment, and how could be useful for our project.**

Keywords*—IoT, Big Data, Data Analysis, IoT Security, Big Data infrastructure

I. INTRODUCTION

IoT has many different definition among scientist and companies. Spite of that differences there is a common agreement regarding its definition: IoT is the seamlessly integration of internet-based sensors and devices in a wide area network that interact with a much more advanced Personal Area Network, allowing us to recognize in a much more detail manner the surround environment and interchange information with it, in an automatic manner. The future applications and research based on IoT will ave a profound impact in the user side, since most of its application will be in areas like: domotics, health, agriculture, intelligent services, etc. IoT is in its early stage development and it has many ethical and technological challenges to overcome [1-10].

Standardization is a mayor issue in IoT, different companies as well as independent organizations has tried to solve this problem with no success so far, or with no general agreement about a single methodology.

In addition to the former explanation, IoT-based applications are useful in a wide area, therefore the definition and application of IoT concepts and methodologies has difuse borders with another well-know disciplines [10-15].

II. ICT AGRICULTURE IN JAPAN

As the vast majority of industrialized countries, Japan has put efforts and economic aid to their research in the applicastion fo ICT in Agriculture. In the particular case of Japan, there are many social factors that directly affect the agriculture industry, like the constant descreasing of agriculture workers, difficult geogrpahy, globalization (in term of competitive prices), etc. In order to tackle this problems, mainly two approaches are developed in Japan:

A. Academic approach

Basically, the academic approach, as in every academic center, is very wide analizing and testing the different potential solutions to any given problem as ICT in Agriculture. Their approach is mainly based on: Sensor networks, cloud computing, augmented reality, control area netowrks, etc. The main issue with academic research approaches is the budget, since it has a competitive intrinsic characteristic, they are not easy to get, therefore, few universities could afford this kind of wide research.

B. Industrial approach

In the case of the industrial approach, there is already a budget ready research topic. This research topic was defined based on the company interests and in specific areas the compnay thinks is necessary to invest or research, indepedently if the research will have or not the desired impact.

III. PROJECT DESCRIPTION

Farmers have been facing different challenges related to their business due to different reasons. In order to solve part of their problems and to create a new business platform the project “Novel nutrition-based vegetable production and distribution system” was created. The initiative of the project was to help farmers with their produce commercialization through the use of technology [15-20].

The creation of this innovative business model required the execution of different steps shown in this section.

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Members and their functions and interconnections are defined as a first step.

1. Farmers

In addition of representing the main project's benefits users, farmers represent the most important information provider. The information provided is vital in order to make the project work.

2. End users

Although farmers are the ones that will benefit from the project, en users will be the ones taking most of the total benefits. Since the project is based on the use of the platform by end users.

3. Restaurants

The "Ready meal" option represent here by the restaurants uses the vegetables provided by local farmers.

4. Knowledge based database creators

Two (2) databases were created during the project development.

4.1. Nutritional requirement information

User's nutritional information, e.g.: user's physical information, status information, physical condition, nutritional requirement, etc.

4.2. Food information

Food/vegetable information, like: nutritional calories, traceability, seasonal information, etc.

Figure 1 shows the schematic diagram of the project.

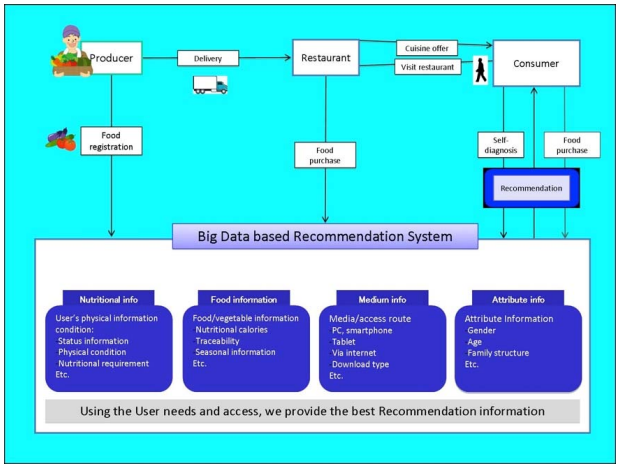

Fig. 1. Project simplified schematic

The project was successfully implemented and this paper discussess its primary results. The next sections of the paper will be dedicated to show the impact the approach had among final users and farmers [21-35].

IV. QUESTIONNAIRE BASED ANALYSIS

In order to understand better the potential market for the proposed system, a series of questionnaires were pruposed. In this section we proceed to present some of the most important ones.

Table 1. Group Universe

Farmers	30 people
Restaurants	30
End users	162 people

Figure 2 shows the general use of internet regarding the search of agriculture related information which is expected in a highly interconnected society as Japan.

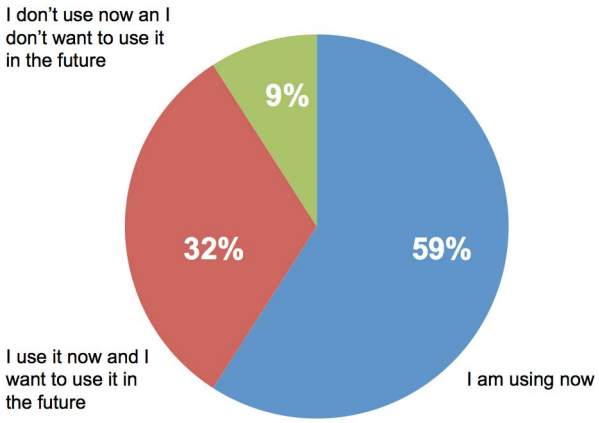

Fig. 2. Information gathering

Figure 3 show the focused information related to the Kumamoto user, which its 90% of usage means a highly available market.

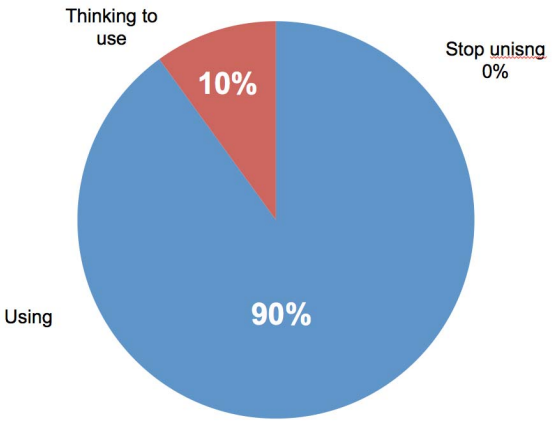

Fig. 3. Use of the internet regarding veegtables in Kumamoto

Figure 4 show us a general profile of the Kumamoto user regarding its preferences about a shop or restaurant. This statistic is important to understand in order to know how to position the product in the future.

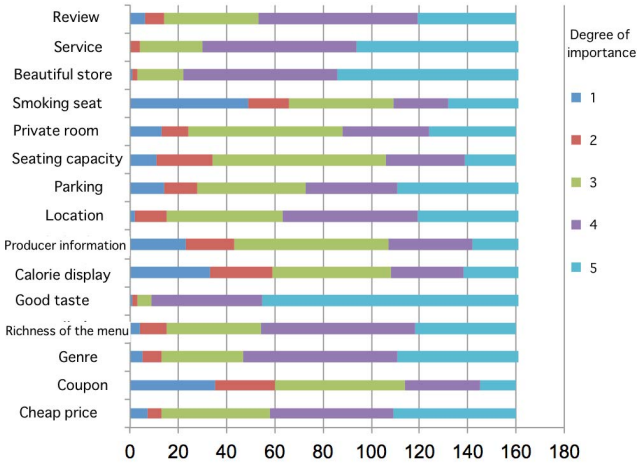

Fig. 4. Important points to select a shop or restaurant

Figure 5 show us the prefered source of information for the user to make decisions regarding where to buy or get delivered their food or vegetables which takes us to Figure 6 where is show the main distribution based on the internet stastistics.

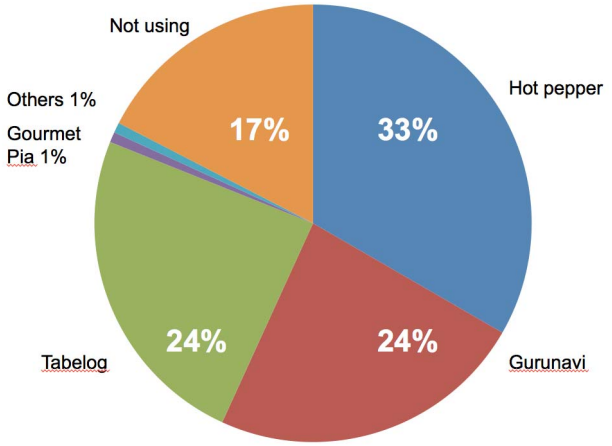

Fig. 5. Prefered source of information to make decisions

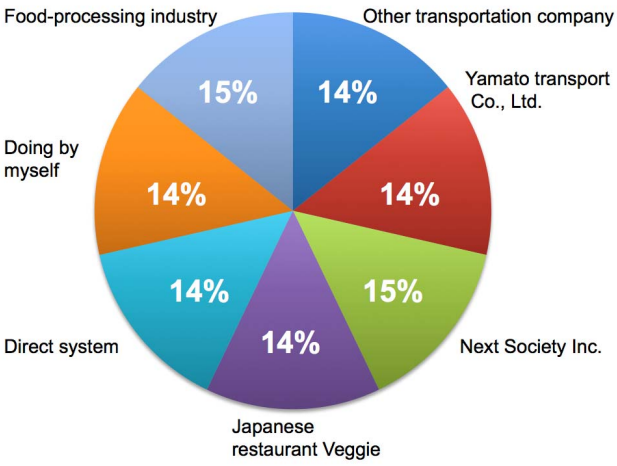

Fig. 6. Main Internet distributions

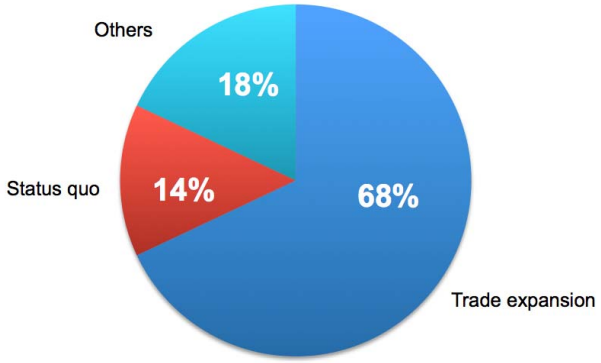

Fig. 7. Hopes of future shipments to end users

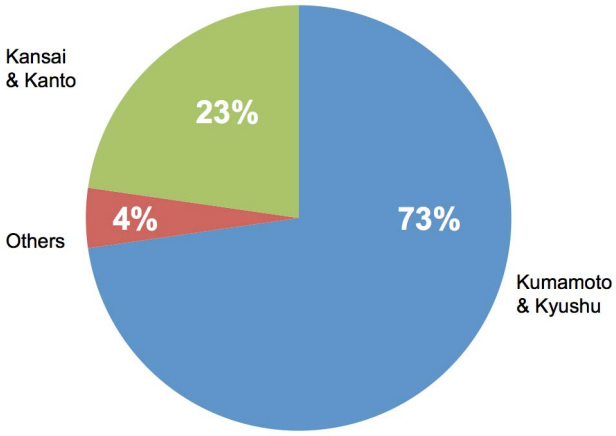

Fig. 8. Main area of shipments

Figure 7 shows the hopes for future shipments to end users. It is necessary to understand that when the system is already in their mature stage it will handle much more information that the one presented in this paper, which means that the hopes presented here could be considered achievable. Figure 8 show us the main shopment areas.

V. Conclusions and Future Work

IoT being in its early stages requires the development of a more standasrdize and ethical based strategy for a stable technology and social growth.

IoT applications are wide and some of the traditional applications are now included or overlapped with recent IoT applications.

Currently in Japan there is a growing concern about the future of the Japanese agriculture due to social problems, like the constant reduction of the working force in the agriculture area and economic issues like foreign competitive products.

The project shown in this paper aims to provide a technological solution to farmers, without being expensive or difficult to use.

The proposed platform integrates farmers and end users in a common environment, where end users could take advantage of the numerous capabilities of fresh vegetables or meals. Bieng their health improvement one of its major benefits.

The common working environemt is analyzed through different questionnaires related to the user profiling and its actions towards the acquisition of information and the media they use for that objective.

As a reflect of the society behavior there is a string use of the internet as a source if information of agriculture or agriculture related products or services which supports the project idea and definition.

Through diverse questionnaires, we were able to gather enough evidence of the project success and correct work path. It is necessary to mention that the different hopes for the project future are realtively normal, which make them achievable in the near future.

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