International Journal of Computer Science
Oddity...Probe...Reviste...
http://www.ijcsjournal.com Volume 2, Issue 1, No 1, 2014. ISSN: 2348-6600
Reference ID: IJCS-035 PAGE NO: 186-196

Application of Cloud Computing to Agricultural Field through Smart Phone

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***Abstract*—** Most of the information technology (IT) systems currently used for duties such as filing tax records and traceability records to meet the requirements of non-farmers in the government and distribution industry. Now a day the formers also started to use the Information technology for their agricultural works via the smart phones. So, this paper focused on introducing the latest technologies such as sensors, wireless networks, and Cloud computing to radically revise approaches to agriculture and conduct business feasibility studies to establish a hypothetical model of Cloud services. It will make a genuine contribution to agriculture. This hypothetical model has much in common with on-site operations such as medical/nursing care and maintenance besides agriculture, so the work is to develop it across a broader range of fields. On the basis of the knowledge acquired through actual agricultural operations and subsequent analysis, this paper will describe the affinity between agriculture and Cloud computing and discuss how the technologies used in the de**m**onstration test can be applied to other fields

INTRODUCTION

Agro meteorological information, in practice mainly climatologically data, is essential in planning agricultural production. The following decisions should not be made without knowing climate conditions:

land use and management, selecting plants and breeds of animals, and crop production practices such as irrigation, pest and disease control and crop-weather relationships.

The specific climate-related information needed is presented below: Before giving recommendations about land use it is necessary to know the environmental conditions.

Parameters required to quantify these conditions are the monthly or 10-day-period rainfall data, solar radiation, temperature and the climatologically risks (frosts, hail etc.).

In order to select plant species or varieties, a prior agro climatologic characterization is required. There is no place for duplication of effort, for absent or weak policy, or for poor communications – each of these potential limitations must be dealt with decisively, and soon.

This section outlines a framework to support the successful implementation of adaptation and mitigation options.

Its three pillars are communications, policy and improved understanding of the problem. This also means that two-way communications are critical.

Indeed, collaborative research and learning is the way forward to get research into use. New ways of working will see researchers defining outcomes – changes in behavior, policies and practice – jointly with stakeholders at the beginning of projects.

This is one of seven 'principles' that have been identified as important for linking knowledge to action.

Strong and diverse partnerships are another. Public–private partnerships in particular are increasingly recognized as a way to facilitate innovation and uptake of technologies.

Knowledge exchange networks are another form of collaboration that will prove essential as rapid information exchange becomes critical.

Many of the world's most vulnerable people depend directly on these systems for their food and livelihoods; and many countries' economies are also highly dependent on

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them. Agriculture is also adding to the climate change problem.

This is the story so far. People are at a crossroads in the development of our planet. The decisions will make now, for agriculture and natural resources as well as for other sectors, may prove to be the most important decisions humankind ever collectively makes.

Due to the early cultivation of plants and crops, the agriculture began in India by 9000 BC. During that period in Indian subcontinent, wheat, barley and jujube were domesticated.

As time passed by, the newer techniques of agriculture became a part of life. In India, 2 harvests are done in a year leading to double monsoons. As a result, Indian products went out of the country and foreign products came inside the country.

To attain a consistent growth in agriculture, land and water bodies were developed. In India, crops were planted in rows of two or six, grains were stored in granaries and threshing was done. All these combined were called as Agro pastoralism.

During the 5th millennium BC, several agricultural communities emerged in Kashmir. Similarly, during the 4th – 5th millennium cotton was cultivated. By the time modern industrialization had emerged in India, Indus cotton industry had been developed and certain method in cotton spinning and fabrication were used. India is the origin of various fruits like mango. Also hemp was cultivated in India. Hemp was used for various applications like making fiber, oil, etc. Peas, sesame, etc. are cultivated by the Indus valley and northern India farmers.

I. AGRICULTURE: METHOD AND VALUE OF ENTERING THE FIELD

a. Agriculture and IT

The more rules that are put to the farmers by the government for the traceable records. In order to improve the agriculture information technology should be used in agriculture. For that farmer should use the efficiency and the succession of the technology in agriculture.

The field work related issues should be demonstrated.

Improved PDCA cycle (clarification of workflow such as issuing instructions and reporting) for that farmer use the latest and formal technologies that are to be implemented in the project. Based on the experience the implication of the project is used.

In many years all the project has been suspended. The combination of the IT industry has been implemented using farmers.

Improved communication and information sharing (in company meetings, etc.)

The experience and the inexperience have been approved based on the performance in the field. The farmers have been used for the field since they are very experienced in it.

b. Summary of demonstration:

After the analysis made in actual farm work for one month they come to the conclusion that it might me possible to support agricultural work with IT.

The following sequence,

Input → data storage → visualization→ analysis → instruction

This paper is used in web applications and Mobile applications and performed verification experiments with the cooperation of farming corporations at two locations in Japan:

1) An outdoor vegetable farm in Miyazaki Prefecture.
2) A rice paddy/dry field farm in Shiga Prefecture

The following shows the verification about the effectiveness from the technical and business view points

Four functions are supported as follows:

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Fig:1 Farm Work Experience

a. Sales/planting (production) Planning:

Performed together on sales to customer and production planning on cultivated land.

b. *Operational planning**:***

Operational planning /result management and progress management and operational checks can be performed on the basis of pre-planned on - site work and automated collection of results.

c. *Patrolling support**:***

Reports and instructions can be easily and reliably issued by sharing on-site photographs and comments among all administrators and workers.

d. Cultivated land data management:

Management of all sorts of data relating to cultivated land, including location, land rights, area, soil, and land characteristics can be integrated.
Four functions are supported by two data management technologies listed below:

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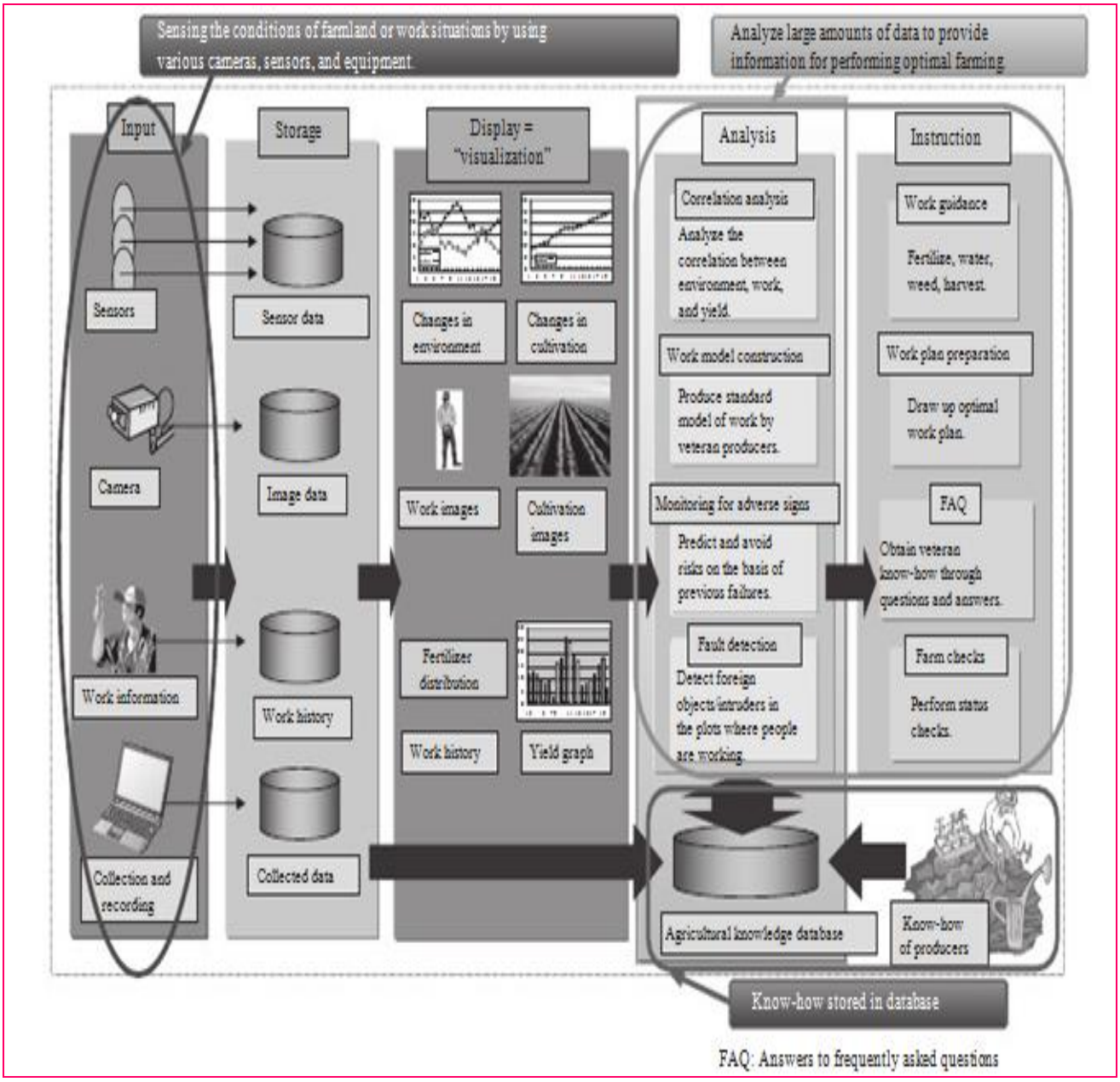

Figure 2
IT Mechanisms to support agricultural operations

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1) Data Storage:

Position and time information from mobile phones with GPSfunctions Weather/soil sensor data.

Image and audio data obtained by mobile phones (with digital camera and audio recorder applications) Noteworthy data extracted from the results of routine work

Materials management data obtained using mobile phones with barcode reading functions

2) Data Analysis:

Registering and updating virtual models and data mining.

This paper plans to construct a series of prototypes and subject them to verification trials.

This paper intends to construct prototypes of two mechanisms and a database, as described below.

A. Planting Simulation :

A mechanism to support the drafting of optimal planting plans based on knowledge management and a cultivated land database.

B. Profit-loss calculations for each plot of land :

Mobile phones with GPS functions are used to automate the collection of position and time data (which is sent to a server automatically by 3G transmissions).

This is used to implement a mechanism for performing profit-loss calculations for each plot of land on the basis of information such as data representing.

which people went where and for how long, which is used to calculate human resources costs that make up the bulk of indirect costs, and material expenses obtained by mobile phones with barcode reading functions.

C. Cultivated land records :

A database of static data such as land rights and land areas, together with plot characteristics, soil analysis results, production histories, and the like.

The managers of the farming corporations that cooperated with the verification trials responded very enthusiastically, saying that implementing these measures would change the face of Japanese agriculture, as a whole, this system is referred to as the "farm work management system".

III. AFFINITY WITH CLOUD COMPUTING

Consider the following Universal values of Cloud computing

- Reduction of initial costs
- Limitless Resource Allocation on demand
- Back end upgrade performance and Maintenance
- Easy collaboration and rapid development with other systems in the Cloud
- Large number of Global service developments

Below figure, PDCA cycle is applied to agricultural work, which performs the following actions

- Plan: Prepare production and operation plans.
- Do: Obtain work results (on-site performance,).
- Check: Watch work progress and patrol the cultivated plots.
- Act: Modify plans, if necessary.

These basic sensing and knowledge management techniques are needed to establish Cloud services

a. *Resources*

Different types of data that are repeatedly collected are weather and soil data, GPS data, image data, worker observations, and data related to cultivated plots of land.

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In every field of industry, frequent bug fixes and upgrades are needed. In Cloud computing, instead of an engineer to have direct visit, the maintenance work for

The quantity collected is 5–10 megabytes per case per day. According to the report of National Agriculture and Food Research Organization, Agricultural data has been stored for 10–30 years and our target in the development of business is between half a million and one million cases, so the total amount of data exceeds 100 pet bytes (comparatively less with the medical field data storage 2 pet bytes per patient).

To analyze this large stored data, data miners are operated in the Cloud. It is not easy to calculate CPU performance as MIPS (Million Instructions per Second) but some measures of highly efficient parallel computer technology is used to calculate.

a. *Maintenance*

In every field of industry, frequent bug fixes and upgrades are needed. In Cloud computing, instead of an engineer to have direct visit, the maintenance work for millions of users can be done through a software on a single system in the Cloud center; Moreover, in Cloud computing, usage of software versions are common among different users, thereby improves usability and reduce maintenance problems.

b. *System cooperation*

India's strengths in individual elemental technologies as well as ability to integrate various technologies together.

Even from a global perspective, there are very few businesses that can combine skills in such as mobile phones and other terminals, network services, multimedia, sensors, business applications and back end server storage.

Indeed, businesses of this sort are nursing to refuse in western developed countries where they have become more specialized since the last century. Companies such as Google are attention towards vertical integration.

To use of the Cloud services offered by India, developer should consider the need for tools that can reach individual users.

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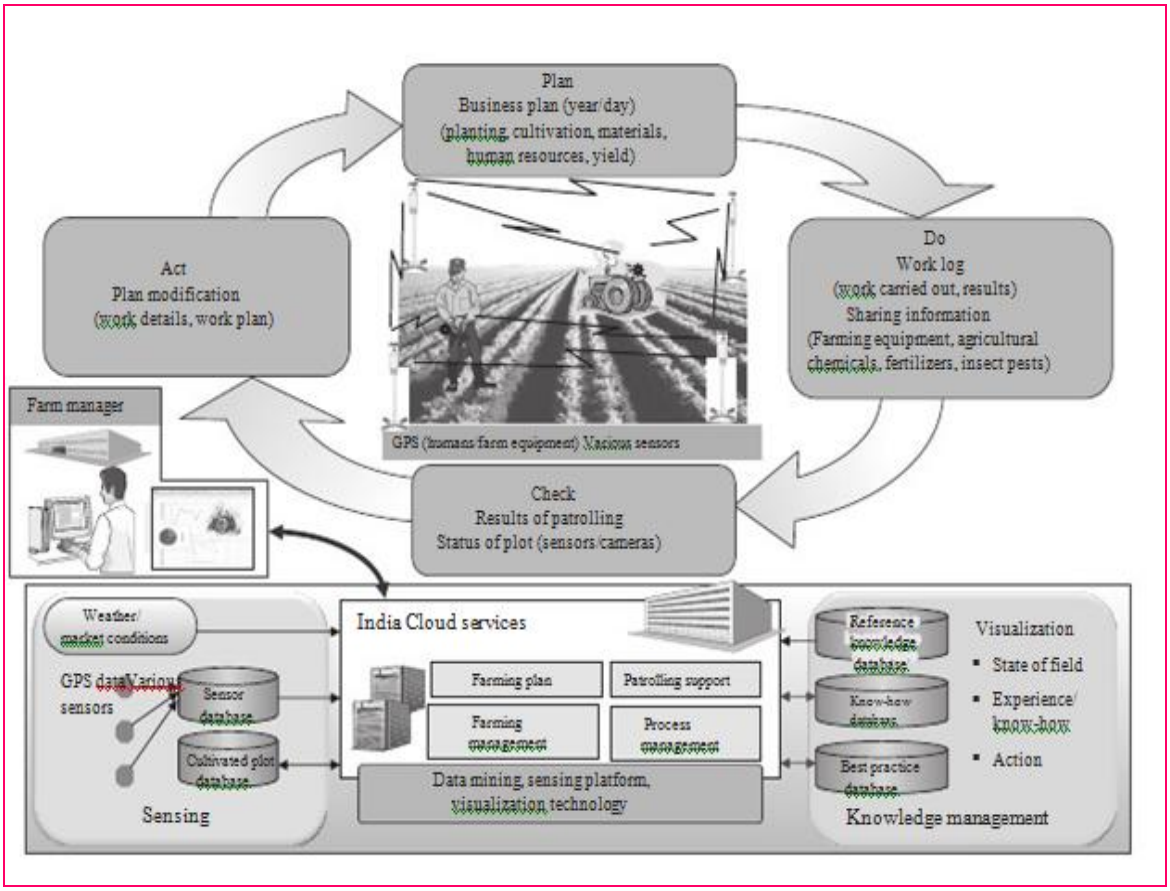

Figure 3PDCA cycle and Cloud Services in agriculture

In this sense India has powerful store for challenging in Cloud services.

So initial model stage, the farm work management system used in the verification trials was aimed at providing total support for agricultural businesses by linking together the following three systems belonging to the Sales Unit,Farming, Forestry & Fishery Systems of India Ltd., India Kyushu Systems Ltd., and India Hokkaido Systems Ltd.:

1) *Business management system*

System for performing financial analysis and filing tax reports with the support of tax counselors.

2) *Production system*

Production history logging system that provides traceability records leading to food that is safer and more dependable.

3) *Good Agricultural Practice operational support*

System that efficiently manages safety and quality improvements in farm produce by supporting the operation of the Good Agricultural Practice farm work standard.

These systems have been utilized by many users such as JA (Japan Agricultural Cooperatives) and agricultural farming corporations since the client-server computing era.

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In the first half of 2009, the movement of business management system to software as a service (SaaS) was completed, and this service has now been launched on India's Service Oriented Platform.

Migration of the production history system to SaaS completed in the first half of 2010. In the future, farmers are expect to tie together the cultivated land records and profit loss calculations for each plot of land, and the planting simulations cited in the previous section .

In the next stage, the person will need to link together supply chain management solution, CRMate Customer Relationship Management solution, Ub! Point and SS tube for handling video information

These are not simply combined into a single system as a sort of mash-up, but are used to provide functions that become necessary when providing services suited to businesses.

The field of agriculture is not just a production activity but also encompasses other forms of communication between people, such as sales and logistics.

In the real world, various mechanisms are connected together. Digital societies are projections of this sort of real world and should all be integrated together.

The field innovations and business method outsourcing promoted by India from the outset are based on this sort of viewpoint. Using Cloud computing to athletically link together a company's diverse systems is one of our guiding principles here at India.

IV. ROLE OF IT IN AGRICULTURE

In the context of agriculture, the potential of information technology (IT) can be assessed mostly under two heads: as a tool for direct contribution to agricultural productivity, as an indirect tool for empowering farmers to take informed and quality decisions which will have positive impact on the way agriculture and related activities are conducted.

Precision agricultural, popular in developed countries, broadly uses IT to make direct contribution to agricultural productivity. The techniques of remote sensing using satellite technologies, geographical information systems, and agronomy and soil sciences are used to increase the agricultural production.

This approach is resources concentrated and useful where large tracts of land are involved. Accordingly it is more suitable for farming taken up on corporate lines.

The indirect benefits of IT in empowering Indian farmer are significant and remain to be demoralized.

The Indian farmer immediately requires timely and reliable sources of information inputs for taking decisions.

At present, the farmer depends on trickling down of decision inputs from conservative sources which are slow and undependable.

The changing environment faced by Indian farmers makes information not purely useful, but necessary to remain aggressive.

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a. IT and Indian Agriculture in the Future

Technologically it is possible to develop suitable systems, as outlined in the previous sections, to provide the information needs of Indian farmer.

User pleasant systems, particularly with content in confined languages, can generate interest in the farmers and others working at the grassroots. It is possible to create enthusiastic networks or attach the power of Internet to make these services is available to all parts of the country.

The task of creating application packages and databases to accommodate to complete range of Indian agriculture is a huge task.

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The Long Term Agriculture Policy provides an in-depth list of all the areas that are to be covered.

This can be taken as a guiding list to change design and develop appropriate systems catering to each of the specified areas. Our country has the advantage of having a large number of dedicated institutions in place catering to various aspects of Indian cultivation.

These institutions can play a vital role in designing the necessary applications & databases and services.

This will make easy modularization of the task, better control and help in achieving quick results.

As it is, several institutions have already developed systems related to their area of interest.

For quick results, it may be useful to get the applications outsourced to software companies in India.

This will help quick operation of applications and provide enhance to the software industry in India.

In order to keep away from duplication of labors, it may be useful to consider promoting a coordinating

organization which will have an suggested role to play in developing standard interface for users, large design and monitoring of the improvement.

In the post WTO command, it is suggested that it is useful to focus more on some rural products to maintain an undeniable competitive benefit for exports.

This will call for vital measures to initiate state of the art technologies such as remote sensing, geographical information systems (GIS), bio-engineering, etc.

India has made rapid strides in satellite technologies. It is possible to effectively monitor agricultural performance using remote sensing and GIS applications.

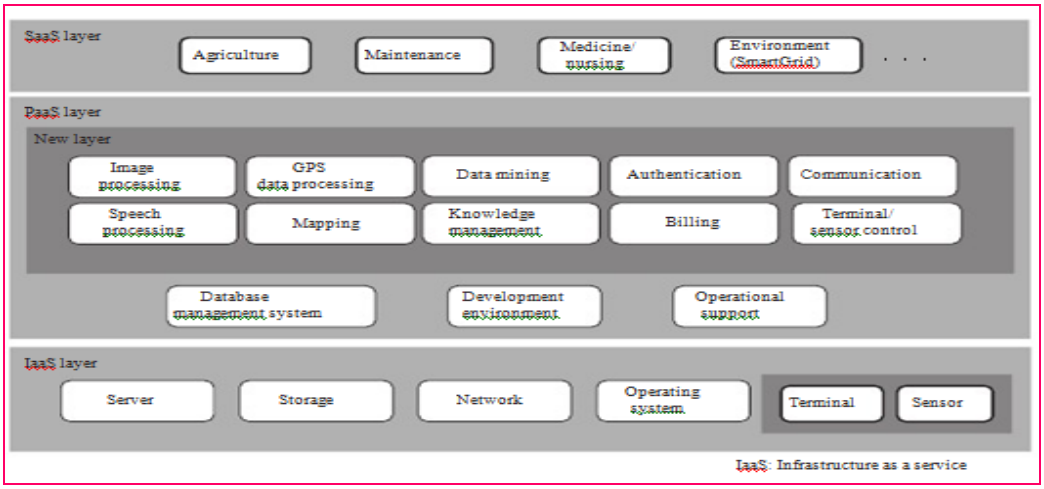

Figure 4 Proposed Layer structure for Cloud services

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This will not only help in planning, advising and monitoring the status of the crops but also will help in responding quickly to crop strain conditions and natural calamities.

Challenges of crop stress, soil problems, and natural disasters can be tackled effectively through these technologies.

A beginning in precision farming can be encouraged in larger tracts of land in which export potential can be tilted in our country's favour.

While developing these systems it is necessary to appreciate that major audience that is targeted is not comfortable with computers.

This places premium on user friendliness and it may be useful to consider touch screen technologies to improve user comfort levels.

It is often observed that touch screen kiosks, with their intuitive approach, provide a means for quick learning and higher participation. It is also necessary to provide as much content as possible in local languages.

Once the required application packages & databases are in place, a major challenge is with respect to dissemination of the information.

The Krishi Vigyan Kendras, NGOs and cooperative societies may be used to set up information kiosks. Private enterprise is also required to be drawn into these activities.

These kiosks should provide information on other areas of interest such as education, information for which people have to travel distances such as those related to the government, courts, etc.

Facilities for email, raising queries to experts, uploading digital clips to draw the attention of experts to location specific problems can be envisaged.

On the basis of these achievements, developer will continue to develop tools for on-site working in other fields where IT has not yet been applied, including home medical care/nursing. In this way, people will hope to contribute to developments not only in Japan but throughout the world.

V. PROPOSED PLATFORM:

This paper also have the role of making proposal for India's Cloud computing platform. Mash ups of the various systems cited in the previous section also require flexibility in the platform structure.

Even when one is considering just one agricultural service application, the required functions include basic authentication and billing functions that can be shared with other fields such as GPS data processing and mapping systems.

Other functions that should be shared with other fields are too numerous to mention, but include image/speech processing and data mining.

These functions can probably be used not only in agriculture but also in any business where work needs to be done on the spot, such as medicine/nursing and maintenance work.

At present, in the verification trials farmers are using a system with a vertically integrated structure, but from the beginning of the prototype development the person have focused on the fact that it is possible to develop horizontally at the platform as-a-service (PaaS) layer.

In the future, in parallel with holding specific discussions for the construction of optimal platforms in a cross-cutting internal fashion, the person also intend to ensure greater exposure of India's elemental technologies that have remained buried until now.

VI. CONCLUSION:

Agriculture maintained by families and communities where the passing on and sharing of knowledge is regarded as very important.

The accumulation and sharing of knowledge has resulted in better overall efficiency and productivity. Agriculture is the embodiment of a large amount of ancient knowledge. If the leverage effects of IT can be has traditionally been widely developed, then people should be

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able to bring about a further leap in agriculture. It goes without saying that Cloud computing can support this process.

At India, by using Cloud computing as an opening into fields where IT has yet to be applied; the people have found that it is possible to establish new models for the application of IT.

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