International Journal of Biological Sciences and Engineering
Vol. 01, No. 01, January 2010, pp. 43-48

Agriculture Wrapped with Social Networks, Data Mining and Mobile Computing to Boost up Crop Productivity

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Abstract: "The backbone of Indian economy" –agriculture which is known for its multi-functional success in generating employment, livelihood, food, nutritional and ecological security is facing several problems in improving the crop productivity. As we had good expertise in the field of agriculture the crucial information is not reaching the farmer community in a timely manner. In this paper we made an effort to find a way out to bridge the gap in the broadcast of information so that timely decisions can be taken for a better farming. We are trying to propose a system which provides advisory services as a decision support to farmers on crop related issues using the mobile services. In addition to these, the effort is being made to familiarize this information through a social network where a human being is a resource to influence others instead of mass media. Initially the proposed system is designed to collect the climatic data and it will be passed to the mobiles of all farmers through messages. There is a coordinator for each region to provide suggestions periodically. At the end of cropping, the coordinator will collect the information like

- Had the farmer utilized the climatic information
- Type of soils
- Type of seeds
- Pesticides used
- Yield information, etc

will be maintained in a database. Applying data mining techniques the results are analyzed. In each location identifying a person, who utilized the services and achieved the higher productivity. He will act as a motivator/educator to other farmers. Through him we will educate/motivate other farmers about to consider and follow the climate alert message information as valuable as mass media.

Introduction:

Agriculture is the backbone for the India's economies as two-third of the population lives in rural areas and depends (directly / indirectly) on agriculture for living. In Agriculture the irrigation systems and the weather are the key factors for cultural productivity, as well as soil properties and natural communities. The effect of climate on agriculture is related to variability's in local climates rather than in global climate patterns. On the other hand, agricultural trade has grown in recent years, and now provides significant amounts of food, on a national level to major importing countries, as well as comfortable income to exporting ones. The international aspect of trade and security in terms of food implies the need to also consider the effects of climate change on a global scale. Climate is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. The Indian farming community is facing a multitude of problems to maximize crop productivity. In spite of successful research on new agricultural practices concerning crop cultivation, majority of the farmers are not getting upper-bound yield due to several reasons. It is true that India possesses valuable agricultural knowledge and expertise such as usage of Crop Weather

Calendar by the Agricultural Meteorological Division India Meteorological department. Such crucial information is not reaching the farmer community in a timely manner. Indian farmers need timely expert advice regarding the climate information to make them more productive and competitive. In this article, we have made an effort to present a solution to bridge the information gap which can be reduced significantly through the IT techniques like mobile computing, data mining and social networks. In this paper we propose a framework for a cost-effective agricultural information propagation system, to propagate expert agricultural knowledge to the farming community in order to improve crop productivity.

This framework is an amalgamation of mobiles computing, data mining and social networks. This framework is scalable which can be incrementally developed and extended to cover all the farmers (crops) of India in a cost-effective manner. It enables the farmer to cultivate a crop with expertise, as that of an agricultural expert, by disseminating climate information through mobiles in a timely manner.

Techniques Used:

Mobiles:

- Now days the cellular phones are personalized with the usage of human being. The mobiles are used by many people for many purposes. Main features of mobiles are:
- For sending messages (text / voice / multimedia)
- Communicating with other people
- Entertainment purpose like taking photos, recordings, storing movies and using as mp3 player.
- As a data carrier with the help of Bluetooth.

Recently, with help of 3G technology the people can make video calling i.e. communicating with other by seeing their image. Here the image is not a static one. It will change with our movements.

Data Mining:

is the process of extracting patterns from data. As more data are gathered, data mining is becoming an increasingly important tool to transform these data into information. It is commonly used in a wide range of profiling practices, such as marketing, surveillance, fraud detection and scientific discovery.

An important part of the process is the verification and validation of patterns on other samples of data. Data mining is the process of discovering from the previously unknown and potentially interesting patterns in large datasets [1].

Social Networks:

is a social structure made of individuals (or organizations) called "nodes," which are tied (connected) by one or more specific types of interdependency, such as friendship, kinship, financial exchange, dislike, relationships of beliefs, knowledge or prestige.

Social networking can be defined as, grouping of individuals into specific groups, like small rural communities or a neighborhood subdivision. Although social networking is possible in person, especially in the workplace, universities and high schools, it is most popular online. This is because unlike most high schools, colleges or workplaces, the internet is filled with millions of individuals who are looking to meet other people, to gather and share first-hand information and experiences about any number of topics from golfing, gardening, developing friendships and professional alliances.

Social network analysis views social relationships in terms of network theory about *nodes* and *ties*. Nodes are the individual actors within the networks, and ties are the relationships between the actors.

Background:

Mobile phones are an important communication channel today. Be it personal or business, dependency on the hand held instrument has become an absolute necessity.

But with the onset of the technological revolution mobile phones are also being used to help the farmer today by informing him when to sow his crops and what

fertilizers to use. Thanks, to wireless solution provider Handygo Ltd, farmers across the country can now learn about good farm practices and share their views with experts on their mobiles. With more than one in every third Indian a mobile phone owner, Handy go has tied up with mobile service provider Bharti Airtel to offer expert advice and information about farming as a value-added service.

Handygo is also negotiating with Tata Teleservices and Idea Cellular to further increase its reach, Handygo Chief Executive Officer Praveen Rajpal told PTI. Farmers will have to call the company's service centre on a particular number charged at Rs. 1 per minute to get inputs about weather, fertilizer, seeds, pesticide and irrigation through its interactive voice response (IVR) technology. The company has hired a team of farm sector experts to answer the queries. The service will also provide weather forecast using its tie-up with the Indian Meteorological Department.

Recently a new research work has been done in agriculture using mobiles and by taking the elders suggestions. This work has been done in Africa. The people took the ideas, suggestions and the cultivation process by the elders. That information is added as the curriculum for the youngsters to teach about the cultivation process in agriculture. They tried to familiarize their suggestions taken from the elders through mobiles. Why they took the help of mobiles is now days mobiles are becoming personalized devices for the human being in day-to-day life. For example, in the year 2000, one sub-Saharan country had 49,000 cell phones in use and by 2004 the number increased to 2, 22,100. Mobiles are explored as a platform for delivery of instructional multimedia and are critical for addressing the digital divides [2], but also progress in developing countries [3].

In this project, science educators and instructional designers are collaborating with elders, teachers, teacher educators and community members in a sub-Saharan African country to establish a mobile network to develop curriculum that draws from local resources and makes them available on a global network. These ideas and curriculum artefacts are shared with educators and designers who are developing instructional multimedia materials to align with and enhance the primary science curriculum by including indigenous knowledge about sustainable agriculture from elders in the communities.

Data sources and analysis:

Data sources include:

(1) audio-recorded interviews with African community elders to learn about the feasibility on connecting sustainable agricultural practices to the primary school curriculum;

(2) audio-recorded interviews with African teacher educator and teachers to assess their feasibility of using mobile, web-based devices as a means of connecting understandings of the use of indigenous scientific knowledge in the curriculum;

(3) Primary school curriculum guides and other artifacts that pertain to indigenous knowledge. Formative evaluation has employed the model proposed by Tessmer (1993) and with additional techniques for alpha and beta testing from Alessi and Trollip (2000).

From a post-colonial theoretical framework [4], we are interested in understanding the cross hybridization of ideas from Western and indigenous science perspectives as we explore teaching about sustainable agriculture.

For this project, the nodes of the network to connect knowledge cultures within Africa and in the United States include the following:

1. A community elder in sub-Saharan Africa is a farmer providing knowledge of sustainable agriculture practices, including channel irrigation, composting, and organic pest control;
2. A science and agriculture educator in sub-Saharan Africa is conducting field testing of mobile devices and sustaible agriculture curriculum with pre-service teachers; and
3. A target primary school classroom and teacher has been selected from a primary science and agriculture class in sub-Saharan Africa.

Moreover, taking the lead from projects such as MobilED (http://mobiled.uiah.fi/), we are exploring text-, voice-, and multimedia messaging, and the potential of solar-powered devices, including battery chargers (Solio, http://www.solio.com/) and wireless outdoor routers (Meraki, http://meraki.com/). The rationale for using mobile phones and hand held devices is that they consume less power than other hardware (e.g., laptops and tablet PCs) and can access the Internet via a cellular network, much needed in a African countries.

Proposed Work:

Now day's Mobile phones are an important communication channel today. Be it personal or business, dependency on the hand held instrument has become an absolute necessity. The usage of mobiles are ONE can observe that during the last decade progress in information technology (IT) is affecting all spheres of our life. Due to progress in hardware technologies, we are able to procure high-speed reliable computers with huge storage capacities at affordable cost. But many of the farmers are illiterate. Due to this many of the farmers are not able to utilize the facilities in agriculture. We are taking the advantage of the mobiles to educate them in agriculture by sending the messages.

By end of the year, at least half of India's 1.2 billion people could be walking with mobile phones, making it the world's largest cellular market, perhaps only rivaled by its neighbor China. India is experiencing an unprecedented spurt in the number of mobile phone users across the country which has breached 450 million subscribers. "We be confident that with 470 million mobile connections in September 2009, we will be well poised to cross yet another landmark of 500 million mobile connections before end of this year", said A. Raja, Minister of Telecommunications and Information Technology. This shows the enormous usage of the mobiles across India. This stand as a stimulator for opting the mobile technology.

Also, database and data warehousing technologies can be used to store and retrieve large amounts of data to deliver the information instantaneously to the needy. Data mining technology can be used to extract useful knowledge from huge databases.

We already defined the social network can built on a specific topic. Any information can be spread through media like newspaper, television and so on. But the "word of mouth" works best than other Medias. For example let us a person wants to purchase a house. To take a decision can be hard to make. The decision to purchase a house by a person can be based on many parameters such as the price of the house, distance from the workplace where he / she working, quietness of the neighborhood, etc. Further, many such parameters are highly subjective and difficult to evaluate or quantitatively compare with respect to other parameters. Therefore, people very often refer to their friends for advice. However, how can the person be sure that opinions from friends represent fairly diverse viewpoints so that she can make a wise choice? This can be applied to agriculture to educate and motivate the farmers in the cultivation process.

Algorithm:

Step 1: Collect the climatic data

Step 2: Forward the information to the farmer's mobiles.

Step 3: Analyze the information using data mining techniques.

Step 4: Identify the farmer with high yield who will act as a motivator for other farmers.

Optimum dates for sowing have been determined for the states of Maharashtra, Rajasthan, Gujarat, Karnataka and Madhya Pradesh by using daily rainfall data from 1901 onwards. Such information helps in deciding the best period for sowing operations, water conservation measures and evolution of appropriate cropping patterns. Correct determination of sowing dates is one of the most crucial decisions in any agricultural operation. India Meteorological Department has therefore started providing on a scientific basis the detailed information on this particular aspect of climate for different states in the form of

publications. Based on daily rainfall distribution for 80 years (1901-80), dates ideal for commencing sowing operations in five states are computed. A number of stations, representing nearly all climatic, soil and cropping zones in the state are selected. With the help of suitable rainfall criteria, the sowing dates are identified and their statistical properties are brought out.

The climatic data collected from the Indian Meteorological Department and is divided based on the regions. The required information is passed to the farmers mobiles as Short Message Service. In parallel we are assigning a coordinator for each region and sending the information like the type of seed, pesticides and so on to be used. Based on the requirements of a farmer this information is propagated as a suggestion while farming. It is left up to the farmer's choice whether to use the provided information or not.

As a part of this process for each region we are assigning a Coordinator for supervising the cultivation process.

- Role of the Coordinator in each region is to collect and maintain the information like
- Receiving the pesticides and other information from the designed system. Based on that data she/he will guide the farmers.
- Visiting the farmers and the land periodically. Sending a report to the designed systems about the updates of farmers and their farming.
- Suggesting them what sort of pesticides to be used for what pests.
- After completion of cultivation process the coordinator collects below data for analysis.
    - Had the farmer utilized the climatic information
    - Soil information
    - Type of seeds
    - Pesticides used
    - Yield information

The coordinator uses the system having the data mining techniques to analyze the data. In Parallel he will send the information to the designed system for the global analysis of data.

Recently Scientists have harnessed a free operating system to turn a mobile phone into a device for collecting data in the developing world. The Open Data Kit (ODK), developed by scientists at the University of Washington, United States, is a free set of tools that helps organizations collect information in areas with poor infrastructure. It uses Android, an open-source mobile operating system launched two years ago by a number of companies including Google.

ODK enables users to collect a range of data including GPS locations and barcode scans. "The tools we've developed can help them collect a wide variety of data, create visualizations, and analyze it very quickly," Hartung said. This tool can be used by the coordinators to analyze the data. The coordinators of all regions will send the analysis report to the system for global visualization.

Finally the coordinator identifies a farmer with high yield as the educator/motivator for other farmers in that region. Here we are including the social network concepts for improving the yield of whole farming community in that region. The motivator will motivate other farmers by illuminating the methodology of his farming.

Note: The designed system can also analyze the data. Both the analysis is verified to ensure the accuracy of the information. Same can be applied for selecting a motivator.

Conclusion:

Through the designed system the former will be benefited to get the high yield, by receiving the knowledge about the climatic information through the mobiles, he will sow the seeds. With the help of coordinators the farmers will get the suggestions immediately about the pesticides for the different pests. All the pest information is provided by the designed system to the coordinator. Based on the farmer's requirement coordinator will guide the farmers. By following the suggestions / guidelines of the coordinator the farmer can improve the yield. We are trying to motivate the all the farmers to take guidelines from the coordinator to improve their yields too.

Future Work:

- Implementing the proposed system in the real world with all facilities like providing the solar batteries for the mobiles to recharge i.e. recharging the mobile batteries with the help of solar system. Through this we can reduce the global warming.
- Though information is now being provided through text messages, the system is targeting to make the service interactive very soon. It is dispersing information in local languages. If the information is in the form voice message in the regional local languages then the problem "the uneducated people are not able to utilize the climatic information through the mobiles" can be solved.

References:

[1] Piatetsky-Shapiro, G., and Frawley, W.J., eds. (1991) Knowledge Discovery in Databases. Menlo Park, CA, AAAI Press.

[2] Jone, M. & Marsden, G. (2006). Mobile interaction design. West Sussex, England: John Wiley & Sons Ltd.

[3] Curry, J, & Kenney, M. (2006). Digital divide or digital development. First Monday, 11(3). Retrieved July 1, 2007 from: http://www.firstmonday.org/issues/issue11_3/curry/index.html

[4] Carter, L. (2004). Thinking differently about cultural diversity: Using a postcolonial theory to (Re)read science education. Science Education, 88(6), 819-836.