Cloud Computing Framework for Agro – Advisory System

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***Abstract*—** In country like India, the technology should be provided to farmers with appropriate guidance to save their crops and their lives. We focused on introducing the latest technologies such as sensors, Cloud computing to radically revise approaches to agriculture by collecting the data about the various parameters of soil, analyze the data and performed the computations, giving the best optimal solutions for the farming to establish a hypothetical model of Cloud services that make a research based contribution to agriculture. On the basis of the knowledge acquired through actual agricultural operations and subsequent analysis, we describe the affinity between agriculture and Cloud computing and discuss how the technologies used in the information exchange that can be applied to other fields. The multi-modal sensory devices have been deployed to capture real time value of the soil parameters such as pH level, temperature, water absorption capacity etc. so that the value is presented to the expert database and the computation will be performed accordingly at the cloud informative services. The application of cloud computing in agricultural economy will open up a vast range of prospects, such as the vast storage of agriculture information, the cloud management of agricultural production process, the online cloud storage of agricultural economy information, early-warning and policy-making based on the agricultural products market, the tracing management of agricultural products quality. Cloud computing is a flexible IT model. It is characterized by rapid elasticity, measured service, on-demand self-service, broad network access, resource pooling. Huge amount of data is collected by the sensors from the end subsequently, this considerably big amount of data must be processed, analyzed and stored in a cost effective ways. In this manner, an enormous pool of computing resources and storage must be provided to compute this vast amount of data.

Keywords-*Cloud computing; Soil sensors; Tracing management; pH level.*

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I. INTRODUCTION

In the current scenario, farmers have very less knowledge about the soil and its parameters such as pH level, percentage of carbon, nitrogen, water absorbing capacity etc. which plays a very big role in the crop production. Farmers are doing the farming based on traditional knowledge so it is difficult for the them to predict that which type of soil is suitable for which type of crop and because of insufficient knowledge farmers are facing loss in the crop production degrading the economical structure of the farmers. RE-ADJUST THESE MARGINS. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided.

As the scientific consensus grows that significant climate change, in particular increased temperatures and precipitation, is very likely to occur over the 21st century economic research has attempted to quantify the possible impacts of climate change on soil. The framework, which is a mobile phone based agriculture advisory system, a farmer can record a query with the help of audio-visual interface on the mobile phone application. The multi-modal sensory devices have been deployed to capture the context of the farm so that the queries along with the context are presented to the agriculture expert at the web console for the investigation. In this paper, we propose an event based experiential computing approach for agro-advisory services. The classification and modeling of agricultural events, modeling of the agricultural experiences, and a method to browse through the history of agriculture experiences soil type, crop, crop variety, season, target, and if available fertility status. In the challenges, involved in the developments of decision support system to be used by farmers as end user are presented, however aims to bridge the gap between farmers, agricultural experts, financial institutions, soil testing labs, agriculture market and other agriculture related institutions. We propose a novel experiential computing approach which aims to provide more insights to an expert by capturing, detecting, storing and analyzing the history of various events in agriculture. Each weather station possesses atmospheric, soil and plant parameters monitoring sensors; data logger and modem for data storage and transmission; battery to energize all blocks of the weather station and a solar panel based battery charging unit. The sensors that are available with weather station includes temperature, relative humidity, soil moisture, soil temperature, grass temperature, wind direction, wind speed, solar radiation, rain gauge, leaf temperature and leaf wetness, and virtual dew point sensor. The data logger on weather station collects the data from sensors and transmits. Each farmer, seeking the service, is initially required to perform registration by providing the details of the field location, crop, crop type, soil type, petiole analysis reports, and history of irrigation, fertilizer and pesticide application on the field.

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II. WIRELESS SENSOR NETWORK

The ZigBee (IEEE 802.15.4) is a new technology that permits the implementation of Wireless Personal Area Networks (WPAN). It is very suitable forwireless sensor networks due to the very low power consumption. This was one of the reasons why it was choose for the implementation of the system presented in this paper. Summarizing, the main advantages of Zigbee in comparison with other technologies such Bluetooth or Wi-Fi are the following:

- flexible network architecture;
- low cost;
- low power consumption;
- large number of nodes (≤ 65.536);
- compatibility of equipments from divers producers;

The main disadvantages are:

- low transmission speed;
- the existence of an single point of failure represented by ZigBee coordinator. The Zigbee technology allows the operation in so called mesh networks that are low cost, self organizing networks of ZigBee devices. The components of the mesh networks can operate over extended periods of time, even years, without changing the original battery. The ZigBee devices operate in unlicensed radio frequency bands (ISM). These unlicensed bands are not the same in all regions of the world, those the ZigBee devices can operate in three frequency bands centered on 868, 915 and 2400MHz.

The most advantageous frequency band is at 2400MHz because of higher data rate (250kb/s) and the worldwide availability. In the 2402–2480 MHz frequency band is used offset quadrature phase-shift keying (O-QPSK) modulation technique. In the 868 The use of O-QPSK and BPSK minimize power consumption and reduce complexity. In the structure of ZigBee networks the devices can be of tree types: Zigbee Coordinator, Zigbee Router and the Zigbee End Device.

Zigbee Coordinator (ZC) – has the function to initiate the network structure by configuring the channels and establishing an ID for that network. It stores the security keys and is capable to bridge toother networks the devices from its own network. *Zigbee End Device (ZED)* – does not participate in routing. It contains only the functionality to communicate with its parent node (the network coordinator or a router). With these types of devices, a ZigBee network can be configured in three topologies: star, a mesh (peer topeer), or a cluster tree. Every network must have one Zigbee Coordinator device. For example, within star networks, the Coordinator is the central node and all the other devices act as end devices. Star topology supports a single coordinator and up to 65536 devices. In the case of tree and mesh networks use ZigBee Routers to extend communication at the network layer.

III. SYSTEM DESIGN AND IMPLEMENTATION

Our wireless sensor network for weather and disaster alert system uses mesh network topology. The system design is divided into two main sections consisting sensor node.

Sensor Node

The sensor node consists of the microcontroller, temperature and humidity sensor, light sensor, pressure sensor and XBee module. The wireless sensor nodes are programmed with C# language. It stays on standby for requests of data transmitted from the server (coordinator with server). Upon receiving the request for weather data, the microcontroller will read the data from different sensors and send the data back to the server (Fig 1 a shows the flowchart of sensor node process).

This experiment is set up with XBee module working in mesh topology. For data transmission, it has only one sensor node which is the coordinator with server for data recording and processing. For the transmission to coordinator, sensor nodes cannot directly contact the coordinator; it needs to transmit data to sensor nodes near the coordinator.

Fig 1.Block Diagram.

In the API Frame type, it can check whether the data has been sent to the server or not. When the sensor sends data out, the server will receive it and send API Frame back to show completed state. Otherwise, it will retransmit such as the destination offline. Requested data from the sensor node, the server will be sent API Frame via sensor nodes. When the data is sent out, the status of delivery will change if the sensor node successfully receives the data. But if there is no response from the sensor nodes, the system will again send the request data in a specified period.

Farmer's query and Expert's Advice: Using the client application on the cell phone, a farmer can raise the query using text, voice, pictures and video. This is further made available on the expert's console for an expert's advice. Any *query* raised by a farmer is considered as an *event*. Similarly, the *response* of the Expert to the query raised by the farmer can be considered as another *event*. This event gives the option to an expert to revisit the past similar queries of the farmers; the responses provided to those queries by the experts; the measures taken (actions performed by farmer) and the resultant consequences.

IV. CONCLUSIONS

Agriculture is the embodiment of a large amount of ancient knowledge. If the leverage effects of IT can be widely developed, then we should be able to bring about a further leap in agriculture. To achieve this, the mechanism of Cloud Computing is highly suited to the task of handing down human knowledge to later generations as Cloud computing having some advantages like easy to implement and scalability, Easy access, reducing maintenance expenses etc. It is suitable to apply cloud computing in the field of agricultural economy. The application of cloud computing will contribute to the rapid development of agricultural economy, speed-up the modernization process of agriculture , and open up a vast range of prospect for agricultural economy information. An efficient event querying model was proposed which helps to query the history of events and their linkages in spatial-temporal dimensions. The expert can browse through this history of linked events while responding to the query of the farmer.

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