Cloud Based Advisory System for Supporting Farmers

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ABSTRACT

Technology can greatly be used to help improve the lives of farmer if properly applied. Mobile technology is the obvious example to go about this as it is commonly available almost everywhere. In this regard we have developed an E-farming app to facilitate this service to farmers. The aim of this program is to provide easy access to farmers on a variety of topics such as crop information and even pesticides such as when to apply them, the quantity, usage, type, so on and so forth. This app follows a three layered deployment option comprising of mobile models, a cloud middleware and our designated database. Since we may need to use this data on an offline situation, caching methodology has been proposed. However a number of problems may arise due to intermittent loss of connectivity. Thus we have adapted a dual caching technique where we store data on the mobile as well as on the middleware. This makes our system more robust and reliable for offline data accessibility.

Keywords : - *Cloud computing, E-farming, Mobile devices, Caching*

1. INTRODUCTION

There is a huge demand for agriculture apps in the market. Due to varying requirements we have seen various types of apps like those that aid agriculturalists to do various tasks such as calculations, decision aids, chemical reviews, GPS-based services and so on. Mobile devices serve as a timely information access point and are convenient to be carried around. The recent advances in cloud computing has also significantly helped this. The main facet is that ICT-based services are outsourced from providers over the internet. Cloud computing has witnessed three major milestones: Infrastructure as a Service (IaaS). Here hardware and networks are offered as virtualized services. Platform as a Service (PaaS). Here application development is hosted by the provider. Software as a Service (SaaS). Here software is made usable to consumers by service providers.

Thus seeing the various prospect we have decided that a distributed mobile app with a cloud oriented back-end is the most feasible. The main purpose of this project is to facilitate easy access to all information which may be needed by the farmer as well as to provide expert support if necessary. The farmers are thus enabled to gather all information pertaining to their requirements from soil quality to crop life cycles to pesticide usage. Fundamentally caching technology is proposed as a measure to support offline accessibility of data in case of connectivity loss.

The only disadvantage this technique may have is that is may lead to the availability of stale data on the mobile app. Thus the farmer will have to deal with outdated information. This usually occurs in rural areas where network signal may be very weak. Furthermore the initially proposed caching methodology may turn out to be inconvenient for bandwidth management.

Therefore we aim to improve on the caching methodology for data synchronization between the mobile and the back-end. We have adapted the dual-caching technology for this purpose. This enable data replication to be achieved on the middleware and mobile nodes. Our findings indicates that we can achieved data synchronization with low latency as well as manage the bandwidth consumption in the wireless network.

We will now discuss various aspects of our project like the existing architecture, state of caching and our proposed advancement. The proposal of caching technique in the previous works as a measure to facilitate offline accessibility leads to challenges with stale data. The question is how the mobile hosted data can be synchronized with the cloud-based backend. This question is not simple to solve just by pushing updates to the mobile because of content adaptation. This means, though there can be updates, the updates may be relevant to only those whose preference criteria has been updated. Hence, not all updates should be pushed across the system.

2. PROPOSED SYSTEM

Our architecture is designed following a distributed mobile pattern. This work cannot follow a standalone design as it will defeat some of the requirements. For example information must be kept up to date and monitored when being sent to farmers. Also attention must be on the size of data being transferred. It must not become overwhelming.

Thus the distributed mobile approach makes the most sense. The architecture comprises of a cloud based middleware, a database server and the mobile nodes. The crop data must follow the REST design standard so it is manageable to process by the middleware. The middleware's main goal is to ensure the database server is shielded from mobile users.

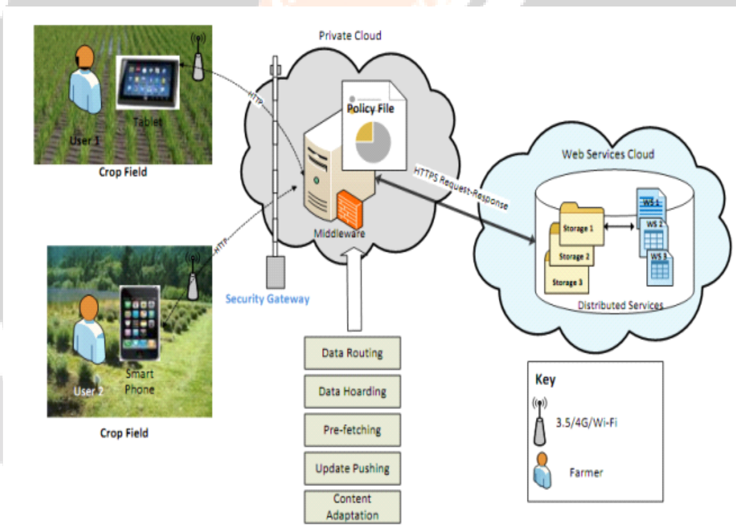

Fig -1: Basic Design

Our main focus is to design the middleware to aid the system in a variety of tasks. These include things like data routing, pre-fetching and caching. This can all be obtained by implementation of a policy based system. This basically constitute a configuration file which is run with a preset compilation of rules. This enables the system to decide which information to send to the farmer as per his requirements and previous usage history. We use a variety of techniques to facilitate this.

This work was further advanced when specified information came into being. Examples being pesticide usage and crop cycles. This follows a personalized content adaption delivery approach. The policy file was re-designed to facilitate this. We use two fundamental criteria: User preference adaption and Device specific adaption.

However to maximize this we need to include caching techniques into the fold. The main advantage of this is that it facilitates offline data usage. However old data has no value. The data cached must be new and relevant. The question is how to we synchronize this with our cloud based database. This means our updates must be relevant to our update criteria. Not all update can be pushed. Stale data in particular must be looked out for.

Here are some research questions that we need to explore.

- When can an update be pushed and when it cannot
- How do we synchronize the system pertaining to a single user
- How do we deal with stale data

3. CACHING

Caching can greatly improve user experience of our system. Web caching is a way to store previous web data to maximize response to request interaction. Mobile data usage led to a surprising revelation that more than half of the traffic constitutes Web browsing. To deal with latency and connectivity issues, caching becomes very important. The most impressive facet is that client data can be stored on client side for future requests. Thus it improves performance and system scalability.

Liu et al. [17] proposed a dual caching model where caches are put on nomadic clients and the server. They showed that it is possible to have two caches where the client shields the mobile client from the interconnectivity problem and the wired side cache shields the loss of connectivity or spotty connection problem. With the proxy side cache, pre-fetching and caching can be used which shields the client from the complexity that arrives from the client disconnection and re-connection problem.

To maintain consistency of data in mobile distributed systems, Wang et al. [7, 8] evaluated a scheme called "scalable asynchronous cache consistency scheme (SACCS)". The authors proposed the scheme to maintain cache consistency between the mobile support station (MSS) and mobile user's (MU) caches.

Further, Ren et al. [9] proposed to use a "semantic caching scheme" while accessing Location Dependent Data (LDD) or application in mobile environments. Also, Frangiadakis et al. [10] did research on the existing caching strategies for mobile environments and observed that "efficiently answering multiple queries" or "reception of the data" is preferred than small delays. They provide analysis of push, pull and hybrid push-pull ratio for efficiently receiving data in a mobile environment.

To reduce energy consumption and latency in mobile applications, Shen et al. [11] proposed the "Greedy Dual Least Utility mechanism", a novel caching method with a cache replacement algorithm and a passive pre-fetching algorithm. However, caching becomes critical for mobile service clients due to connectivity problem and limited bandwidth.

The third feature of REST introduced by Fielding [12] in his doctoral dissertation is "client-cache-stateless-server". REST is absolutely vital for mobile clients because here caching and proxies can be used as notion of the state is clear. The semantics are well known [13] and changes in states are clear which is very important for caching.

4. CONCLUSION

Our project is aimed at supporting crop farmers to make decisions on how to apply pesticides, when to apply the pesticides, which ones to apply, and so on. The application was designed as a distributed system where a middleware is proposed. Furthermore, the caching technique was put forward to support offline accessibility of the pesticide information in the event of network loss. However, caching can lead to situations of stale data especially when there is no connectivity for a long time.

In this paper, we proposed the dual caching technique as a measure of pushing updates to the mobile in real time. A proxy layer is introduced that keeps mirrored copies of the information on the database server. Furthermore, the farmers are able to store device specific caches and later share the cache data. The pilot testing we conducted shows high performance boost especially with the minimization of latency. The future direction of this work is to incorporate weather and GPS-based services.

5. REFERENCES

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