Mobibush: A Cloud Enabled Mobile App for Farmers

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ABSTRACT: Mobile technology is increasingly being adopted in the agricultural space as a measure to assist farmers in decision. In this regard, the MobiBush project was initiated by the researchers from the College of Agriculture at the University of Saskatchewan, Canada, and the Multi-Agent Distributed Mobile and Ubiquitous Computing (MADMUC) Lab. The aim of the project is to enable farmers to have mobile access to up to date information on pesticides and further make decisions on which pesticides to apply, how to apply them, when to apply them, and so on. Due to its complexity, MobiBush is designed as a mobile distributed system that follows a three-layered deployment; comprising of mobile nodes, a cloud-hosted middleware, and a cloud hosted database server. Since the data that is being pushed to the mobile is resident on the database server, caching methodology on the mobile has been proposed to support offline accessibility of pesticide information. However, there are challenges that arise due to the intermittent loss of connectivity which leads to stale data on the mobile. In this work, we have adapted the dual caching technique where we store data on the mobile and on the middleware. The approach makes the MobiBush architecture now robust and reliable for offline data accessibility.

KEYWORDS: Mobile devices, Middleware, Web services, Pesticides, Caching, Cloud Computing

I. INTRODUCTION

There is a relentless ascent in the quantity of horticulture applications that are being conveyed. Because of the high differing qualities of the recorded, we have seen the outline of versatile applications that guide agriculturalists to finish undertakings, for example, figuring, choice guides, compound audits, GPS-based administrations, thus on. Cell phones serve as an auspicious data access point and all the more essentially, they are advantageous to be conveyed around. Likewise, the late advances in distributed computing, the period where ICT-based administrations are outsourced from suppliers over the Internet, is being grasped inside of the agrarian scene. Asindicated by the works in and further, distributed computing has seen three major taxonomic layers known as the: Infrastructure as a Administration (IaaS) where equipment and systems are offered as virtualized administrations, Platform as a Service (PaaS) where application advancement is facilitated by the supplier, and Programming as a Service (SaaS) where programming is made usable to customers by administration. Having seen the prospects, the MobiBush project was proposed as an appropriated portable application with cloud-arranged back-end. The objective of the MobiBush undertaking is to help crop ranchers to settle on snappy choices on pesticide applications. For the most part, the agriculturists are empowered to know which pesticide to apply, when to apply the pesticide, how to blend chemicals, howto focus weeds, etcetera. Some of the screenshots of the MobiBush application. In the beginning outline of the application, the reserving strategy is proposed as a measure to bolster disconnected from the net availability of information in the case of asystem disengagement. The test however is that, the reserving technique can prompt circumstances of stale information on the portable, which implies, the agriculturists won’t have the capacity to get to crisp (redesigned) data yet obsolete data. This circumstance emerges at the point when agriculturists are on the homestead where system signs are feeble or absolutely distracted. Moreover, the at first planned storing redesign strategy is not helpful for data transfer capacity administration.

Mobibush consists of three main parts: 1. Android application (user centric app) 2. GSM toolkit 3. Website

1. Problem statement:

There are several ongoing works on promoting mobile technology usage in the field of agriculture. Mobile devices can play integral role in farm monitoring. We proposed an architecture that comprises of data acquisition layer and processing systems. Overall, the work can be monitored from several crop fields and their utilization.
Goals and objectives:

Goals:
A system of cultivation management, Agro-Sense, is proposed, which is developed to support efficient farming management. Farmers can upload their data on Mobile Database. Data include parameters such as name of farmer, crop, season, time, pesticides and profit. The data will be shared among all other farmers. Farmers on farmland can easily refer to work plans, enter field data into the Mobile system, and share them with head office in real time by using PC AND MOBILE.

Objectives:
The design and develop a system which enabling the Mobibush App on the mobile as a self-contain application. This means, the entire business logic, storage, and presentation of the App reside on the mobile for farmer and farming purpose. Application also intended to share the pesticide information between themobile and the back-end instead of just delegating everything. To achieve this, themobile node has to be designed to have an execution state engine also designed on the web-hosted middleware.

Statement of scope:
- The standalone (network independent) farmer helping app
- Soil Information analyser using Embedded Hardware Geological survey and analysis
- Automated work management using Auto-Seed Planting ROBOT. WeatherForecasting
- Distributed architecture through data offloading and data partitioning.

Major Constraints:
The crops are damaged in field itself due to disease attacks and lack of information resources. So we are intended to use, monitored soil information using H/w Kit to crop fields and their utilization as well as better crop growth analysis. The challenge however is that, the caching methodology can lead to situations of stale data on themobile, which means, the farmers will not be able to access fresh (updated) information but outdated information. This situation arises when farmers are on the farm where network signals are weak or totally unavailable. Furthermore, the initially designed caching update methodology is not convenient for bandwidth management.

Outcomes:
- Symptoms inference.
- Symptoms diagnosis.
- Geological positional survey.
- Geological soil analysis.
- Weather Forecasting

MOBIBUS ARCHITECTURE

Fig.: Mobibus Architecture
In System Architecture we design and develop a system which enabling the Mobibush App on the mobile as a self-contain application. This means, the entire businesslogic, storage, and presentation of the App reside on the mobile for farmer and farming purpose. Application also intended to share the pesticide information between the mobile and the back-end instead of just delegating everything. To achieve this, the mobile node has to be designed to have an execution state engine also designed on the web-hosted middleware.

III. MAJOR TASKS

3.1 Soil Property Analysis:
A row guidance method is presented to guide a platform which is designed independently to drive through the rowcrops in a field according to the design concept of open architecture. This project is basically developed to implement a number of agricultural activities in many countries, such as ploughing, seed dispersing, picking, harvesting, weeding, pruning, planting, grafting, etc. In addition, the different agricultural parameters such as moisture content of the soil, irrigation facilities and motor control are also managed and the farmer is alerted about all the parameters with the help of SMS sent through the GSM module. Here we are proposing an agricultural autonomous Robot which will disperse the seeds in an orderly manner. While doing so it will take into account the distance between two seeds planted, the depth at which they are planted and the number of plantations that it has completed. All these parameters can be adjusted using the switches provided. A row guidance method is presented to guide the robot platform to plant the seeds in grid comprising of rows and columns. In addition to the seed dispensing mechanism it will also have a watering mechanism to water the seedlings as soon as they are planted. So, altogether we can say that this is a completely an autonomous robot.

3.2 Data Collection:
Open Government Data (OGD) Platform India data.gov.in - is a platform for supporting Open Data initiative of Government of India. The portal is intended to be used by Government of India Ministries Departments their organizations to publish datasets, documents, services, tools and applications collected by them for public use. It intends to increase transparency in the functioning of Government and also open avenues for many more innovative uses of Government Data to give different perspective. The base Open Government Data Platform India is a joint initiative of Government of India and US Government. Open Government Data Platform India is also packaged as a product and made available in open source for implementation by countries globally. Open Government Data Platform India has 4 (four) major modules, as detailed below, implemented on a single Drupal instance An Open Source based Content Framework Solution Data Management System (DMS) Module for contributing data catalogs by various government agencies for making those available on the front end website after a due approval through a defined workflow. Content Management System (CMS) Module for managing and updating various functionalities and content types of the Open Government Data Platform India Platform. Visitor Relationship Management (VRM) Module for collating and disseminating viewer feedback on various data catalogs. Communities Module for community users to interact with other members and share their zeal and views with others, who share common interests as that of theirs. Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries Get data on Estimates of yield rates, and share of ram/weather, ewe, lamb in wool Production. It contains data of Ram/Weather Average Yield/ season, Ram/Weather Wool Production, Ewes Average Yield/season, Ewes Wool Production, Lamb Sheeps horn, Lamb Average Yld./ season, Lamb wool Production, Wool annual Estimates.

3.3 Data Upload:
Data transferring action is finished transmission of a document from Laboratory framework to Cloud Server. From a system client’s perspective, to transfer a record is to send it to server, that is set up to get it. Individuals who offer information with others on transfer administrations (US) transfer records. The File Transfer Protocol (FTP) is the Internet facility for downloading and uploading files. (If you are uploading a file to another site, you must usually...
have permission in advance to access the site and the directory where the file is to be placed.) When you send or receive an attached file with an e-mail note, this is just an attachment, not a download or an upload. However, in practice, many people use "upload" to mean "send" and "download" to mean receive. The term is used loosely in practice and if someone says to you "Download (or upload) such-and-such a file to me" via e-mail, they simply mean "Send it to me."

3.4 Data Download:
As a apps store their data in a cloud Server, only work when an Internet connection is available. But its a much (faster) user experience if your app can work even without an Internet connection. The idea is to create a local server or cache of your data so you can access it whether the user is online or offline. And then when the user is online, you synchronize the cache and the remote database according to District and user position.

IV. DATA MODEL AND DESCRIPTION

4.1 Data Description:
Since some users may change their associated attributes at some point (for example, moving their region), or some private keys might be compromised, key revocation or update) for each attribute is necessary in order to make systems secure. This implies that revocation of any attribute or any single user in an attribute group would affect the other users in the group. For example, if a user joins or leaves an attribute group, the associated attribute key should be changed and redistributed to all the other members in the same group for backward or forward secrecy.

4.2 Data objects and Relationships:
1. User should be connected with application.
2. Application should be connected with server.

4.3 Functional Model and Description:
a. Authentication
b. Verification
c. Algorithm Calculation on Android App

![Fig.: Functional Model of MobiBush](image)

Weather Forecasting In India farmers rely on weather forecasts to decide as what to work today and tomorrow. Whether to dry hey or keep it inside. The frost and freeze damages the crops in spring and thus what is the condition for next few days. Hence, AgroMobile provides SaaS to monitor the weather conditions without typing any location or position as it will be automatically located using the mobile device GPS system. And also farmers can query for the temperature and humidity required for the particular crop(s) as an Android application.

Crop Advice and Analysis India has mainly two agricultural seasons in a year the Kharif season or summer season and the Rabi seasons or winter season. Thus, a proper advice for the correct crop to plant is very much needed to fulfill the need of India. Farmers more than an age of fifty uses their own traditional way of cultivation and harvesting and may result good but the new farmers with young age group mess up and results failure. Here, AgroMobile computing helps such farmers to look up the correct crop to plant after a particular crop. This IaaS also provides information for a single,
double and multiple cropping and increase the knowledge of crop rotation and the mixed cropping. This all service is in real-time and on the users mobile device itself in a customized form.

V. TOOLS AND TECHNOLOGIES

5.1 Hardware:

5.1.1 Moisture Sensor:
The moisture sensor measures the humidity content of the soil. The relative humidity of the soil is represented in terms of the RH value which is converted into the appropriate voltage level by the sensor. The following are the specifications of the moisture sensor.

a. Output range 1.41V to 3.55V
b. High reliability and long term stability
c. Fast response time
d. Patented solid polymer structure
e. Suitable for linear voltage or frequency output circuitry

5.1.2 Temperature Sensor:
The LM35 make interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 draws only 60 A from the supply, it has very low self-heating of less than 0.1°C in still air. The LM35 is rated to operate over a 55°C to +150°C temperature range, while the LM35C is rated for a 40°C to +110°C range (10% with improved accuracy). The LM35 series is available packaged in hermetic TO-transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-pin surface mount small outline package and a plastic TO-220 package.

5.1.3 MAX 232:
RS232 standards: To allow compatibility among data communication equipment made by various manufacturers an interfacing standard called RS232 was set by the Electronics Industries Association (EIA) in 1960. Today, RS232 is the most widely used serial I/O interfacing standard. This standard is used in PCs and numerous types of equipment. However, since the standard was set long before the advent of the TTL logic family, its input and output voltage levels are not TTL compatible. In RS232, a 1 is represented by -3 to -25V, while a 0 bit is +3 to 25V, making -3 to +3 undefined. For this reason, to connect any RS232 to a microcontroller system we must voltage converters such as MAX232 to convert the TTL logic levels to the RS232 voltage levels, and vice versa. MAX232 IC chips are commonly referred to as line drivers.

5.1.4 Sensors:
System sensors are used for the farmer to perform easy operations in his farm. Temperature sensor is used to detect motor temperature. If motor temperature increases beyond specific temperature then motor will turn off automatically. Humidity sensor is used to detect soil moisture. At the time system 3 phase induction motor is in on state. Humidity level of soil is full filled at that time motor will turn off automatically. Water level sensors are used for detect water tank level. Water tank level sensors detect full, middle and bottom level of tank gives information. If motor is in on state but water tank level is below critical level. At that time motor operate on empty state this is harmful for motor.

5.1.5 GSM Modem:
GSM (Global System for Mobile communication) is a digital mobile telephony system. With the help of GSM module interfaced, we can send short text messages to the required authorities as per the application. GSM module provided by sim300 uses the mobile service provider and send SMS to the respective authorities as per programmed. This technology enables the system to communicate wirelessly and has no specified range limits. GSM uses a variation of time division multiple access (TDMA) and the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band. It is a tri-band GSM/GPRS module with keypad and LCD support and it has an embedded powerful TCP/IP protocol stack. It has a GSM multisto slot class 10/8. It can be controlled via AT commands. It requires 3.4 to 4.5 V power supply and can be operated between the normal temperature range of -20 to +60°C. It has a 60 pin board to board connector and two analog audio interfaces. Ever there is an error in phase. Also the farmer can start and stop the motor using his mobile phone. We can also incorporate a status feedback system in this project. The farmer will get the updates on the present status of the
motor such as the motor temperature by just sending a message. In this project we will also be monitoring the drip irrigation facilities by measuring the moisture content of the soil using a suitable water level in the tank. In that module we can give 3-phase connection means R, Y, B phase to the pin 'no. RA0, RA1, RA2 respectively. I can take the exact status of phase manage the start and stop situation via GSM module. GSM module connected at pin RC6 and RC7 by using MAX232 IC. System is monitoring temperature of motor by sensing temperature of motor I stop the motor when temperature will go on critical level because of that I can protect motor overheating situation. Temperature sensor connected at pin RA3. System is taking humidity of farm soil. Monitoring soil moisture farmer take decision about start motor or stop motor. Also when motor is in start position that time reading goes beyond the set humidity level motor stop automatically by microcontroller. Humidity sensor connects at pin System is also taking tank water-level status. Tank status farmer can manage motor controlling easily. Tank level is at full and middle position motor start. At the time tank level down to bottom level that time motor automatically stop. Also farmer can start motor via GSM module that time module first send tank status. By using tank level farmer can protect his motor. Water tank level sensors connect at pin RC0, RC1, and RC2 i.e. Full, Middle, and Bottom level respectively. At the time of farmer can start motor that time motor not directly start therefor I give RELAY ON connection that connection continuously motor is in supply mode. RELAY ON connect at pin RD2. Also message comes that time motor can start and stop situation I gives supply to RELAY OFF pin. RELAY OFF pin connects at pin RD1 pin. Supply is given to RELAY OFF pin this trigger the motor to stop position. All sensors reading are displayed on LCD display. LCD display connect at PORT B. I can use a 4-bit data transfer mode can reduce these to 8 lines. Serial interface is another option that can reduce the number of microcontroller pins needed for LCD interface significantly. PORT B is 8-bit pin RB4, RB5, RB6 and RB7 which use for data transmission purpose and RB0, RB1, RB2, RB3 use for resistor select, read/write, enable and backlight control respectively. Also RB6 and RB7 pin use for program burning process. These two pins are connected to the switch when switch is on state then pins operate on program burning process and switch is in release state then pin use for LCD connection.

Fig.: Circuit diagram of GSM Toolkit
5.1.6 Supply Boards:
Reset is used for putting the microcontroller into a 'known' condition. That practically means that microcontroller can behave rather inaccurately under certain undesirable conditions. In order to continue its proper functioning it has to be reset, meaning all registers would be placed in a starting position. Reset is not only used when microcontroller doesn’t behave the way we want it to, but can also be used when trying out a device as an interrupt in program execution, or to get a microcontroller ready when loading a program. In order to prevent from bringing a logical error to MCLR pin accidentally, MCLR has to be connected via resistor to the positive supply pole and a capacitor from MCLR to the ground. Resistor should be between 5 and 10K and the capacitor can be in between 1f to 10 f. This kind of resistor-capacitor combination, gives the RC time delay for the controller to reset properly. Pins OSC1 & OSC2 are provided for connecting a resonant network to form oscillator. Typically a quartz crystal and capacitors are employed. The crystal frequency is the basic internal clock frequency of the microcontroller. The manufacturers make available PIC designs that can run at specified maximum & minimum frequencies, typically 1 MHz to 16 MHz. Here we are connecting two ceramic capacitors which are basically used for filtering. That is to give a pure square wave to the microcontroller. Serial data communication needs often dictate the frequency of the oscillator because of the requirement that internal counters must divide the basic clock rate to yield standard communication baud rates. If the basic clock frequency is not divisible without a reminder, then the resulting communication is not standard.

VI. RESULTS

After successful connection of mobibush application and GSM toolkit user has register first. After registration authentication is done by the server that user is valid. Successful validation gives permission to user to access mobibush application. With the help of this app user can check machine status that it is on or off. The machine can be start by pressing START button on the screen and get off by pressing STOP button. If user click on STATUS button message send to the GSM toolkit and it will reply the moisture of the soil, humidity, temperature of soil, water level. Also user will get the information about the crops, fertilizers details, disease details, weather report, disease list, expert advice, suggestions etc.

Fig. : Screenshots of MobiBush App
VII. CONCLUSION

Thus we conclude mobibush is a project that is aimed at supporting crop farmers to make decisions and caching technique is used to support offline accessibility of pesticide information in the event of network loss we have studied quality attributes of the system.

VIII. ACKNOWLEDGMENT

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