

Innovative Mobile Visualization platform: specification on a prototype mobile application for agriculture

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Abstract-There is a demand for mobile applications linked data visualization for presenting the various data. The main aim of the research is to design and develop the inventory network incorporation applications could give huge monetary and social advantages among them, making employments, including esteem, decreasing item misfortunes, and making developing nations all the more internationally focused.

Keywords- mobile visualization; mobile; agriculture;

I. INTRODUCTION

Nowadays, Mobile technology has rapidly turned into the world's most basic method for transmitting voice, information, and administrations. Today, information perception has turned into a quickly developing mix of science and art that is sure to change the corporate scene throughout the following couple of years. In this paper, the focus is on implementation of data visualization in mobile applications that will easily present any data to the users for analyzing it using their visual sensations.

Data Visualization is the presentation of information in a pictorial or graphical organization. It empowers decision makers to see examination introduced visually, so they can get a handle on troublesome ideas or distinguish new examples. With intelligent perception, the idea can be taken a step further by utilizing innovation to penetrate down into outlines, diagrams for more detail, intuitively changing what information are seen, and how it is prepared. But, regardless of the few studies on the mobile revolution by Alamri [1], there is an absence of precise pattern examinations, in-depth contextual analyses, and appraisals of encounters with mobile applications.

In order to engage with the above challenge, the contributions of this paper are to present the development of a mobile platform that will assist the farmers for development of the agricultural industry. This research will be conducted by gathering of previous 5 years from 2011 to 2015 agricultural data of UK. The data collection will include the total crop area available, total crop yield, total crop production over the available crop area and the Farmers

response rate on the crop production. Hence this initiative has been taken to meet the request that present the required data on agricultural sector in an easy with the help of data visualizations tools.

II. LITERATURE REVIEW

A. Overview of Data Visualization

Data Visualization is a general term depicts any effort to assist individuals for understanding the vitality of information by putting it in a visual setting. Examples, patterns and relationships that may go undetected in content-based information can be uncovered and perceived simpler with information representation programming [27]. The modern tools for data visualization go past the standard outlines and diagrams utilized as a part of Excel spreadsheets, showing information in more refined routes, for example, data illustrations, dials and gauges, geographic maps, flash lines, heat maps, and point by point bar, pie and fever graphs [6]. The pictures might incorporate intuitive abilities, empowering clients to control them or drill into the information for questioning and investigation. Pointers intended to ready clients when information has been upgraded or predefined conditions happen can likewise be incorporated.

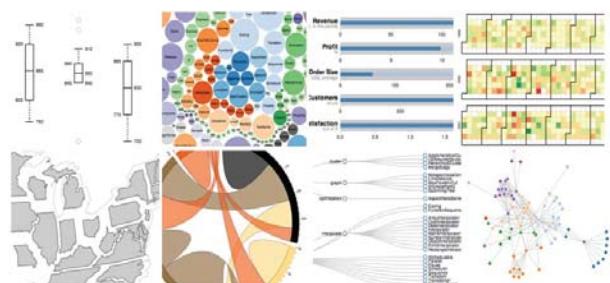


Figure 1. An Overview of Data Visualization
(Source: Bostock 2016)

The idea of utilizing pictures to comprehend information has been around for a considerable length of time, from maps

and diagrams in the seventeenth century to the innovation of the pie outline in the mid-1800s. A very long while later, a standout amongst the most referred to illustrations of measurable design by [20] happened when Charles Minard mapped Napoleon's intrusion of Russia. The guide portrayed the measure of the armed force and in addition the way of Napoleon's retreat from Moscow and attached that data to temperature and time scales for a more top to bottom comprehension of the occasion [2]. It is innovation, in any case, that genuinely lit the flame under information representation. PCs made it conceivable to process a lot of information at extremely quick speeds. Today, information representation has turned into a quickly advancing mix of science and craftsmanship that is sure to change the corporate scene throughout the following couple of years [10].

B. Data Visualization Tools

Data representation is the graphical showcase of unique data for two purposes: sense making (additionally called information investigation) and correspondence. Critical stories live in the information stream and information perception is an effective intends to find and comprehend these stories, and after that to present them to others. The data is dynamic in that it depicts things that are not physical. Measurable data is unique [22]. Whether it concerns agrarian information, money related up ascend because of horticultural division, absolute harvest zone and yield or whatever else, despite the fact that it does not relate to the physical world, it can even now be shown outwardly, yet to do this there is a need to figure out how to offer structure to that which has none [16]. This interpretation of the dynamic into physical characteristics of vision (length, position, size, shape, and shading, to give some examples) can just succeed if there is understanding somewhat about visual discernment and comprehension. At the end of the day, to picture information viably, plan standards must be taken after that are gotten from a comprehension of human observation [21]. Thusly, there is a need to execute information representation devices for the improvement of Mobile applications that can introduce the interpretation of theoretical into physical traits of vision.

As per Xia [30] the current device for information perception that can be actualized for outlining the portable applications is D3.js, which is a JavaScript library for controlling reports taking into account information. D3 breathes life into information utilizing HTML, SVG, and CSS. D3's accentuation on web principles gives the full abilities of cutting edge programs without binds to a restrictive system, joining effective perception segments and an information driven way to deal with DOM control [3]. D3 permits tying subjective information to a Document Object Model (DOM),

and after that applying information driven changes to the archive. For instance, D3 can be utilized to create a HTML table from a variety of numbers [18]. On the other hand, utilize the same information to make an intuitive SVG bar graph with smooth moves and association.

D3 is not a solid structure that looks to give each possible component. Rather, D3 tackles the essence of the issue: effective control of archives taking into account information. This evades exclusive representation and manages remarkable adaptability, uncovering the full capacities of web guidelines, for example, HTML, SVG, and CSS. With negligible overhead, D3 is to a great degree quick, supporting huge datasets and element practices for collaboration and movement. D3's utilitarian style permits code reuse through an assorted gathering of parts and module [21].

C. Summary

Mobility visualization applications could offer innovative, dynamic and interdisciplinary services. Today smart phones are available in a variety of platforms like Windows mobile, Android and iOS in both mobile and tablet versions. The mobile applications should run on multiple platforms to allow for greater technology transfer. The applications may introduce some basic features and provide advanced or customizable features at a later stage or on minimal chargeable basis. To overcome these challenges, efforts are being made by to design the mobile visualization platform, which should be across platform.

III. ARCHITECTURE OF MOBILE PLATFORM

This mobile platform has been developed with the help of data visualization and analytics tools. For the development of this application, it is necessary to create a User-friendly interactive design, which can help to analyze the input data in some specific format. Hence, the mobile application with data visualization has been designed by utilizing Adobe Dreamweaver, Android Studio [29]. There are different types of scripting languages that have been used for the structural design of the mobile application. This application can perform different types of data analysis by collecting huge amount of data. The data binding is done among the data stream input with the assistance of json and tsv like standardized data format [9]. Apart from these basic tools, the application has been developed with the implementation of a major data driven technology i.e. D3.js. D3 enables web applications DOM model, which assists to create successive development over advanced HTML and XHTML documents. DOM provides an organized tree structure over every HTML

property [25]. json is one type of JavaScript notation file to provide simultaneous data interchange in between objects and database. The main software or a tool, which is used to develop this android application, is Android Studio. Android Studio provides highly structured android library functions for development of android application [15].

A. System Design

The main functionality of this application is resided in between two main approaches. And these are collecting data from a specific data source and produce a graphical representation of it [26]. Although the several functions are associated with this application development but their perspectives are not taken as major concern. For making an effective result over the deployment of this application D3.js API is implemented here. Whereas D3.JS API provide an efficient result towards the collected data to producing high scalable visual data representation [19]. D3.js provide a huge and versatile library for creating function for visual representation and in this application some this d3.js functions are implemented like append data [8], SVG value creation, d3 scaling,D3 JSON, csv data collections etc. D3.JS have a capability of processing among collected raw data. So it can easily track down object value processed it through visualization framework. In this application all the d3.js scripts data stream are feed with .tsv and .csv data form with a distinguishable field in TSV or CSV [14]. The main reason behind utilization this of two different data format to maintaining process overhead. In here one application needs to be prepared a huge dataset collection and for this CSV format data is pretty much useful. On the other hand TSV format is implemented to make a quick access among small data driven objects [28].

B. Problem Analysis

Making of android application is gone through some sequential steps of software development where each development segment is related to another segment. If any development phase creates an ambiguity towards its procurement then this will effect on entire systems. Apart from its code accessibility the major function which can capitulate the deployment is application interface [5]. This application needs to be scalable on every devices, otherwise this application cannot perform its functionality on different type devices. If the development process does not maintain this terms then this application can create different orientation of different type of devise [12].

Platform compatibility is also another fact which is primarily concerned with the development phase. In first stage of android application development, android studio

provides a vast range of application supported platform [17]. And for making an application developer must need to select an entity form the platform. This selection will ensure that the proposed application can perform its functionality without any problem. This application untied D3.Js and D3 is only supported from Android version 3 [23].

C. Requirements Analysis

The requirements of this application can be divided into two categories one is primary requirement and other is secondary requirement. The primary requirement is concerned about application development phase and Secondary requirement are make to fulfill the application deployment objectives [11]. For development part the initial requirements are android development studio with android software development kit version's 22, D3.js API, SVG controller, java development kit or JDK 1.8 Java runtime environment or JRE and other software components which are cautiously associated with Android studio [1]. Here other components are like apache ant, Gradle like repositories. Gradle is used to make controller on domain specific language and it also provides automation tool to compute it in a standardized manner [13].

IV. Case study

The developed prototype android application maintains a standard layout formation to provide visualization of the agricultural data which is collected from the different area of crop production. In first view of the application it provides visualization of an overall production review. The front view is also divided in two categories one is navigational unit and another is table view of overall dynamic visualization [29]. In navigational unit there are three sections provided which are used to control over three different project application segments. Each segment represents a unique view of bundle data about from 2011 to 2015 with a tooltip function. The other components that have been implemented in the system are:

- D3 select option - D3 gives two top-level strategies to selecting components: "select and select all". These techniques acknowledge selector strings; the previous chooses just the principal coordinating component, while the last chooses every coordinating component in report traversal request [22]. These techniques can likewise acknowledge hubs, which are valuable for mix with outsider libraries, for example, jQuery or engineer instruments.
- D3 selector - Chooses the primary component that matches the predetermined selector string, giving back a

solitary component determination. In the event that no components in the present archive coordinate the predefined selector, gives back the vacant choice [15]. On the off chance that different components coordinate the selector, just the main coordinating component will be chosen.

- D3 node selection - Chooses the predetermined hub. This is helpful on the off chance that you as of now have a reference to a hub, for example, d3.select(this) inside of an occasion audience, or a worldwide, for example, document.Body. This capacity does not navigate the DOM [25].
- D3 select all - Chooses all components that match the predetermined selector. The components will be chosen in record traversal request (start to finish). On the off chance that no components in the present archive coordinate the predefined selector, gives back the unfilled determination [29].
- D3 select all node - Chooses the predetermined exhibit of components. This is valuable on the off chance that you as of now have a reference to hubs, for example, d3.selectAll(this.childNodes) inside of an occasion audience, or a worldwide, for example, document.links. The hubs contention doesn't need to be a cluster, precisely; any pseudo-exhibit that can be pressured into a cluster (e.g., a Node List or contentions) will work. This capacity does not navigate the DOM [9].
- SVG elements - All SVG shapes can be changed utilizing the change trait. You can apply the change either to the shape straightforwardly, or to a containing g component. Accordingly, when a shape is characterized as "pivot adjusted", that only means hub adjusted inside of the nearby organize framework; you can even now turn and generally change the shape. Shapes can be filled and stroked utilizing the fill and stroke styles [24].

A. Functionality

This prototype application is mainly designed to provide an analytical function over collected data and for this application there are two types of utility plug-ins are used from D3.js library function. One is tooltip function and the other is SVG layout creation. Tooltip function provides a details information when the application objects are touched or clicked [15]. As an example when user clicks over 5 years data objects then a dynamic value appears which display the units of the visualized data. Another tooltip function is SVG layout which is used to create dynamic layout to visualize different types of analytical reports [4].

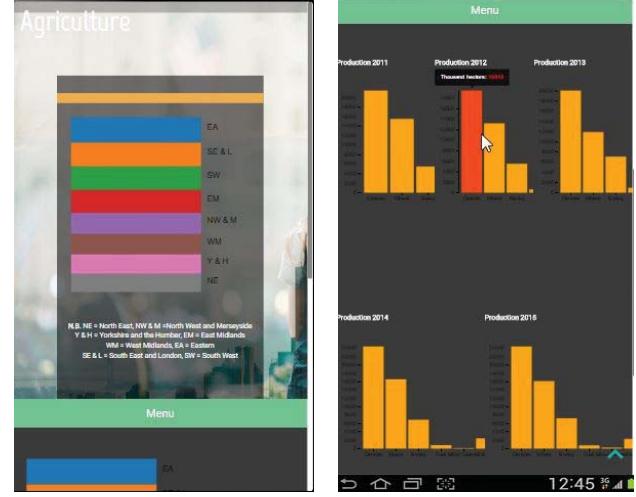


Figure 2: Layout of the Mobile Application

Clients of applications incorporate a wide range of gatherings. Also, the client can request for the hyper-neighborhood content. The application gives the details about the reason wise agriculture details. Mainly five rezones are given bellow which gives the agriculture historical data year wise. These five rezones are North east (NE), North west and Merseyside (NM & M), West Midlands (WM), eastern (EA), south east and London (SE & L), south west (SW). The crop production option shows the historical view of the crop which is produce in the year between 2011 to 2015. The crop yield shows a histogram of yield production from 2011 to 2015.

B. Limitations

This prototype application has a great environment towards data visualization but this application can create visualization over initialized data. In this initialization data is also bound with its desired variables anything change with data variable can stopped the visualization over SVG item.

This prototype application is one type of offline android application. So the application can't get any information about its future developments. This application is also not capable of sending its bug report to its vendor servers. And for this developer is not aware about any development flaws which are associated the android application.

V. CONCLUSIONS AND FUTURE WORK

This report contains about the mobile prototype application for the agriculture and also describes the mobile

extensive variety of capacities in the field of agriculture. This system will help to give the business sector data, expanding access to augmentation benefits, and encouraging business sector joins. On the other hand the client can access the agriculturists, produce purchasers, cooperatives, info suppliers, content suppliers, and different partners who request valuable, reasonable administrations.

This application could give huge monetary and social advantages among the people related with the agriculture. Therefore, this study does with the analysis on importance of mobile applications for the development of Agricultural industry. The Mobile applications were designed in the D3.js, which provides better flexibility than JavaScript's. The developed mobile application helps the users to view the agriculture data. The mobile applications should run on multiple platforms to allow for greater technology transfer. There is a huge potential for innovation through mobility in agriculture.

As part of future extension this application can integrate dynamic data binding for form base data input which is very essential for any type of analytical application. There are also several functionalities are available which accelerate the application versatility. There some features which can implement on this existing application are: a) Export option for creating dynamic data elements of visual representation. b) Creating option for generate snapshot of projectile data.

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