Web-Based Market Information System for Farmers in Palestine

نظام معلومات السوق المستند إلى الويب للمزارعين في فلسطين

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Abstract

The advances in information and communication technologies (ICTs) provide great tools for development in Palestine, especially utilizing the availability of internet access through web-based applications. One important sector to benefit from ICT tools is the agricultural sector. Farmers need to be empowered with technology to make the best use of the scarce resources of the farm. The main objective is to identify and analyze relevant material and information flows, production processes, and their interconnections and synergies in the agriculture sector. Market Information Systems for Farmers (MISF) is an information system used to gather, analyze, and disseminate information about agricultural yields, prices, and other information, such information is relevant to farmers, traders, dealers, and others involved in handling agricultural products. In this paper, we propose a system that will address some of the problems facing the farmer markets. This new approach will make the farmer and the buyers responsible for uploading their agricultural products, harvest data, and price information using the MISF website and the MISF application on their mobile devices. In this research, a descriptive approach was used to analyze the agricultural information marketing system. First, data related to our system was gathered using a literature review of research, reports, questionnaires, and site visits. We then used an Object-Oriented Approach to apply a system analysis and represent our solution using UML Notation, graph, figures, and tables. In this paper, we will try to address some of the problems facing the farmer markets. The proposed system will facilitate trade by creating a capacity for sellers to contact individual buyers. This system will provide information on what agricultural products are in demand by analyzing consumer consumption and market trends. The system will collect demographic details such as the types of crops grown, crop size, prices, cost, and maybe access to the type of irrigation, soil, and fertilizers as inputs from the farmers as well as other information about crops consumption. The data gathered by the proposed system can be used to advise farmers about needed crops and suggest ways to help them lower costs and improve productivity; this can be achieved using data mining techniques and maybe the Internet of Things (IoT). In general, the system will track farmers' daily activities, businesses and provide ongoing support in areas such as labor, costs, yields management, crops consumption, harvest management, market price discovery, and strong relation with buyers.

Keywords: *Market Information Systems, Web Application, Farm Management, Farm software.*

الملخص

تُقدم التطورات في تكنولوجيا المعلومات والاتصالات (ICT) أدوات رائعة للتنمية في فلسطين، لا سيما الاستفادة من توفر الوصول إلى (الإنترنت) من خلال التطبيقات القائمة على (الويب). يعتبر القطاع الزراعي أحد القطاعات المهمة التي يمكن أن يستفيد من أدوات تكنولوجيا المعلومات والاتصالات. ويحتاج المزارعون إلى دعمهم بالتكنولوجيا لتحقيق أفضل استخدام للموارد النادرة للمزرعة. والهدف الرئيس هو المساعدة في تحديد المواد ذات الصلة بتدفق المعلومات وتحليلها، وعمليات الإنتاج، والترابط والتآزر في قطاع الزراعة. ونظم معلومات السوق للمزارعين (MISF) هو نظام معلوماتي سيتم استخدامه في جمع المعلومات حول المحاصيل الزراعية والأسعار وغيرها من المعلومات وتحليلها ونشرها، وهذه المعلومات ذات صلة بالمزارعين والتجار، والبائعين وغيرهم من المشاركين في التعامل مع المنتجات الزراعية. وفي هذا البحث، نقترح نظاما يعالج بعض المشكلات التي تواجه أسواق المزارعين. وسيجعل هذا النهج الجديد المزارع والمشترين مسؤولين عن تحميل منتجاتهم الزراعية، وبيانات الحصاد، ومعلومات الأسعار باستخدام التطبيق (MISF) على تطبيق (الويب) وأجهزتهم الخلوية. في هذا البحث تم استخدام المنهج الوصفي لتحليل نظام تسويق المعلومات الزراعية. أولاً، وتم جمع البيانات المتعلقة بنظامنا عن طريق مراجعة الأدبيات للأبحاث والتقارير والاستبيانات، وزيارة المواقع الزراعية. ثم استخدمنا المنهجية الكينونية لتحليل النظام ولتمثيل الحل الخاص بنظامنا باستخدام تدوين UML والرسم البياني والأشكال والجداول. في هذا البحث، وسنحاول معالجة بعض المشاكل التي تواجه أسواق المزارعين. وسيسهل النظام المقترح التجارة من خلال خلق قدرة للبائعين على الاتصال بالمشترين بشكل فردي. وسيوفر هذا النظام معلومات حول المنتجات الزراعية المطلوبة من خلال تحليل استهلاك المستهلك واتجاهات السوق. وسيقوم النظام بجمع التفاصيل الديموغرافية، مثل: أنواع المحاصيل المزروعة، وحجم المحاصيل، والأسعار والتكلفة، وربما الوصول إلى نوع الري والتربة والأسمدة كمدخلات من المزارعين، يضاف إلى ذلك معلومات أخرى حول استهلاك المحاصيل. ويمكن

استخدام البيانات التي تم جمعها بوساطة النظام المقترح لتقديم المشورة للمزارعين حول المحاصيل المطلوبة، واقتراح طرق لمساعدتهم على خفض التكاليف وتحسين الإنتاجية، ويمكن تحقيق ذلك باستخدام تقنيات استخراج البيانات، وربما إنترنت الأشياء (IoT). بشكل عام، وسيتتبع النظام الأنشطة اليومية للمزارعين، والأعمال التجارية، ويوفر الدعم المستمر في مجالات، مثل: العمالة والتكاليف وإدارة الغلة واستهلاك المحاصيل وإدارة الحصاد واكتشاف أسعار السوق والعلاقة القوية مع المشترين.

الكلمات المفتاحية: نظم معلومات السوق، تطبيقات الويب، إدارة المزارع، تطبيقات المزرعة.

INTRODUCTION

Accurate and easy to use Markets Information Systems for Farmers (MISF) are of fundamental importance for successful operational farm management. However, many farmers still do not use MISFs for various reasons, like lack of knowledge, absence of these systems, and the complexity of the available systems.

Developing a market information system that uses information and communication technology comes in handy for all agriculture sector stakeholders. The system can be used in the field of agriculture to provide efficient information management, flexible knowledge and information sharing, local and global communication, and production planning. It should be mentioned that researchers can use the data gathered by this system to improve the agricultural system. This ultimately results in an overall increase and improvement in the productivity in agriculture and thus the economy.

In recent years, new business models for agricultural markets have appeared. Under this perspective, there is a need for a new information system for urban markets to facilitate transactions. Both sides, consumers and farmers, require certain information from markets about agricultural products. For example, consumers may make requests about the exact information of agricultural products or their safety, while farmers may want to boast about their products. Under the considerations of such requirements at the markets, which may be conflicting, we will propose a new information system to assist in the negotiation between both parties.

The main objective of the study is to develop a market information system for farmers (MISF) and digitize it using Internet websites and smart devices. This step helps and strengthens the local agricultural system, improves productivity, improves lives, and provides jobs for farmers in Palestine. It also helps provide and create new markets and value chains, bring together a wide range of local and regional stakeholders, and strengthen relationships between farmers and trusted consumers (Abuzir, Awad, and Khdair, 2021). The market information system will play an important role in agro-industrialization and food supply chains.

Research Objectives

The main goals of this paper are:
- To study the development of Markets Information Systems for Farmers (MISF) using web-based and mobile applications in the context of a farmer application.
- To use technology to strengthen the local agricultural system and improve productivity for everyone in the agriculture value chain, including small farmers.
- To improve the lives and livelihoods of farmers in Palestine.
- To bring together a wide array of local and regional stakeholders to form a mutually beneficial value chain.
- To create access to new markets, value chains, and business models.
- To develop stronger relationships with trusted farmers and consumers.

These are the issues that were addressed in this paper:
- What problems can arise when developing Markets Information Systems for Farmers (MISF)?
- How can these problems be addressed by developing an Internet-based website and mobile applications?
- What problems and limits arise with the usage of the developed system?
- What benefits of MISF for the agricultural sector?
- What research possibilities are available using the data accumulated by the system?

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This manuscript consists of seven sections. This section introduced the problem, problem statement, and the main objectives of the system, while the second section provides a literature review. The third section introduces the research methods, research instruments, and system structure. The fourth section discusses the system analysis, design and implementation. In section six, we discussed the results, while the last section provides the conclusion.

LITERATURE REVIEW

Syed Khizer (2017) conducted a study about the development of an online marketing information system for the agricultural sector of KSA. He emphasized the importance of the agriculture sector, which generates labor and capital and fulfill domestic demand to support growth in other sectors. Additionally, the agriculture sector plays a key role in ensuring national food security. Access to agricultural marketing information is an essential factor in promoting competitive markets, globalization, efficient marketing, market liberalization, and improving agricultural sector development. The majority of the stakeholders of this sector do not use agricultural marketing information. The stakeholders of the agriculture sector of Saudi Arabia need Agricultural Marketing Information System (AMIS).

Mawazo M. Magesa, Kisangiri Michael and Jesuk Ko (2014): This paper reviewed the agricultural market information services in developing countries. This study has explored the use of agricultural market information services in linking smallholder farmers to markets, especially in sub-Saharan developing countries. Origin of, the needs for, and the current status of agricultural market information services in developing countries are clearly presented. Lastly, the study explored the limitation of the success of most agricultural market information services in sub-Saharan developing countries.

C.G. Sorensen, S. Fountas, E., et al. (2010), in their paper presented a conceptual model of a future farm management information system (FMIS). The aim of this paper is to define and analyze the system boundaries and relevant decision processes for such a novel FMIS as a prerequisite for a dedicated information modeling. The boundaries and scope of the system are described in terms of actors and functionalities, where actors are entities interfacing with the system (e.g., managers, software, databases).

Mishra et al. (1999), Muhammad et al. (2004), Forster (2002), and Doye et al. (2000) covered the importance of farm management issues. The skillful and conceived management is one of the most important success factors for today's farms. Only when a farm is well managed can it generate the funds to finance its sustainable development and thereby, its survival in today's fast-changing environment. However, sophisticated management is a challenging and time-consuming task and must be organized as efficiently as possible.

Shepherd (2011) and David-Benz et al. (2011; 2016) indicated that the first-generation market information systems were mostly based on a single model, regardless of the market being studied, the type of product, and the country. Other systems often focused exclusively on price information, relied on project-based financing, and were imperatively implemented by public bodies, such as marketing boards and ministries (Rubio (2020); Nwafor et al. (2020); Muto (2009); Aker (2010); Belakeri et al. (2017); Chikuni et al. (2019); Roslin et al. (2020); Emeana et al. (2020)).

Several studies by David-Benz et al. (2011; 2012), (Galtier, 2014), and Mukhebi and Kundu (2014), showed the importance of the spread of mobile phones and the Internet, which paved the way to the rise of a new generation of Management Information Systems (MIS). The Information and Communications Technology (ICT) sector developments have made it possible to minimize the lag in transferring price data from collection points to Central Processing Units (CPUs) and disseminating information to the intended recipients. MIS that uses ICT has become known as the "second generation" MIS, or the 2GMIS "Second Generation of Management Information Systems.

Artificial Intelligence (AI) and Data Mining (Abuzir, 2018) are expected to report significant growth in the near future in the agricultural industry. Farmers can track their livestock in real-time by making use of AI. Dairy farms can now individually monitor the behavioral aspects of animals with AI solutions, including picture classification with body condition score and feeding patterns and facial recognition for

livestock. Furthermore, farmers use machine vision that allows them to identify facial features (Global, 2020).

MATERIALS AND METHODS
Method and Data Source

Based on our previous study (Abuzir, Awad, Khdair, 2021), as well as the main findings and recommendations of that study, it was concluded that ICT could play an important role in promoting and developing central markets in Palestine by organizing and saving time, effort, and money in all sectors. In this research, we implemented the recommendation by creating a web-based market information system and mobile application to benefit and for the use of the concerned parties.

In the first step, we reviewed historical and recent literature to understand and analyze Market Information Systems. Then we used a questionnaire to collect data from farmers and the other stakeholders in the following governorates Ramallah, Nablus, and Salfit. Then, we applied a system analysis to identify and analyze all the material and information flows, the production processes, and their interconnections and synergies.

Data related to the system were collected from different sources using various instruments and techniques as a literature review of journal articles, reports, legislation, case studies, on-site visits, and questionnaires for farmers and administrators.

We consequently gathered information about farmers containing all relevant data related to our study. Moreover, the collected data provided the basis for the development of the Market Information System, which describes all relevant factors of the system like input and output, reports, resources, production processes and activities, services, and administration.

In this research, a descriptive approach was used to analyze the agricultural information marketing system. Data were identified, grouped, and classified in order to answer problem questions and identify suggested solutions. We represented the results of the analysis and the solutions using UML notation. In addition, the solutions and the analysis are represented in various formats such as shapes, charts, and tables.

Proposed System Structure

The requirements analysis started with identifying and defining the scope and objective of the system for Market Information System for Farmers (MISF) based on a study of Abuzir, Awad, and Khdair (2021). So, the requirements for MISF were derived from that research. In their study, a survey was conducted to assess the user's expectations on future Information Technology, Internet Functions, and online services for farmers.

A questionnaire has been performed and analyzed, collecting feedback on the interpretation of the reality of the agricultural markets in Palestine, the levels of difficulties and problems facing the current distribution system, to what extent do the market information system contribute to achieving an efficient system, and to what extent are the technological requirements available for the market information system? These questions were studied and analyzed using SPSS to develop the conceptual architecture of MISF. A literature analysis was done on developing the agricultural system of the markets information system for farmers in Palestine. Table 1 presents a summary of the results of the different statistical methods used in this study to analyze the data collected by the questionnaire.

The results in Table 1 show that there is a general agreement among the different parties in the market (farmers, traders, specialists) that the current traditional market system is not efficient. It provides limited possibilities regarding marketing and information. Among the first core area, this item: "The local bodies that supervise the markets are effective and efficient," scored the lowest level of agreement at 43.4%, with a mean of 2.17, which is the lowest value for the first core area, thus indicating clearly the need for a new efficient system.

The second core area shows that the kind of difficulties facing the agricultural sector is related to the conventional system in use. All these problems can be solved using a well-designed information system. An example is a response to this item: Administrative costs for import (insurance, transportation, freight, fees, etc.) are reasonable, which scored the lowest level of agreement at 42.3%, with a mean of 2.11, which is the lowest value in the second core area.

Table 1: A Summary of the Results of Analysis of the Data Collected by the Questionnaire

Sub Question (Core Area)	Mean	Standard Deviation (SD)	Percent %	Attitude
Total Score of: The reality of the markets in Palestine	3.0714	0.37440	61.4%	**Medium**
Total Score of the: The levels of difficulties and problems facing the current distribution system	3.4286	0.36444	68.6%	**Medium**
Total Score of: To what extent does the market information system contribute to achieving an efficient system	3.9086	.77427	78.2%	**High**
Total Score of: To what extent are the technological requirements available for the market information system?	4.0980	.69622	82.0%	**High**

Another indicator is the answer to this item which scored the highest level of agreement: The ability to promote efficient agricultural transactions and contact agricultural supplies' companies, at 84.0%, showing an over-willing agreement to use the MISF.

Finally, the results for the fourth core area show that there is a high level of agreement for the role that is expected by technology is highly positive and will improve the overall performance of the market.

Besides the results of that study, the requirements analysis, the reference architecture for MISF was designed. The proposed system is shown in Figure.1. An approach that is user-friendly and fast to monitor and fulfill the user requests is implemented using a centralized server to store all relevant data. It includes various databases such as users, lands, agricultural supplies selling points, agriculture directorates, weather, research, crop, and farmers-related data that can all be stored at a single location on the server, thus making it available to all intended users. This data can be easily accessed by the end-users such as farmers, experts, consultants, researchers, etc., at any time from any location through computers or smartphone devices that are connected to the system. A generic user interface can be used that facilitates accessing the system for information.

The system was developed for the different stakeholders comprising the farmer, agricultural trader, agriculture production factory, Ministry of Agriculture, agriculture directorate, and agricultural supplies selling points.
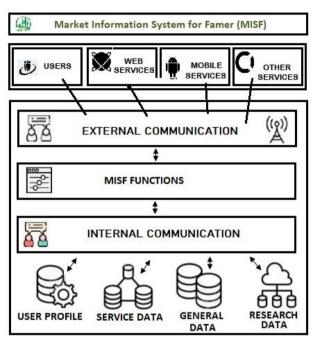

Figure.1. Proposed System

Information management (related to crop, soil, and production process) is easier as it will be managed by the service providers, a farmer, while other information as weather, wind type, wind speed, wind direction, and humidity are managed by the system. MISF obtains weather data from one of the most famous global sites specialized in weather forecasts via web API services to analyze and present it in a simple framework that helps the farmer and those working in the agricultural sector to understand the data and benefit from it. The system provides users with another information that is generated by the directorates of agriculture and the ministry of agriculture, such as planting seasons, dates for harvesting agricultural crops, dates for spraying pesticides and medicines, and fertilizers, announcements about the availability of seedlings, announcements from the ministry, farmers or agricultural instructions.

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The effective use of information technology in the agricultural sector will bring positive changes by utilizing its key features.

The following benefits may serve as reasons as to why Information technology is necessary to be implemented in the agricultural sector:

1. Information management (related to crop, soil, weather, and production process) is easier as it will be managed by the service providers and promotes the circulation of agricultural products.
2. The system will reduce the long supply chains and complex links between farmers and consumers, making it difficult for the farmers to derive benefits and value from the markets.
3. Data availability at any time and at any location.
4. Technical issues will be reduced as the system handles them.

Figure 1 provides a high-level view of the Market Information System for Farmer architecture design. It describes the generic structure (concepts and relations) of our system. A Market Information System for Farm architecture structure is described according to the requirements and specifications that were defined in the next Section, "System Analysis and Design." The architecture comprises five main components:

- Users and Services
- Interface Communications
- MISF main Functions
- Internal communication
- Databases

Figure 1, summarizes the core of MISF and the framework for the MISF. It is an independent software running on the user's computer and smartphones with connectivity to the MISF database using a complete web-based MISF application. The MISF offers other services to users as the ministry of agriculture and moderator. The MISF stores users' profiles and data generated by services in their own format in their databases. The MISF, on the other hand, is an application framework that provides generic functionalities for service providers to offer different services to users. The MISF provides functionalities for adding crops, land, or services into a marketplace where other users can discover and use these services. Furthermore, the MISF provides a vertical communication (interface) enabler for communication between different services into the MISF based on the service usage.

In the next sections, an illustrative is provided to show how the different components of MISF fit together in practice.

SYSTEM ANALYSIS AND DESIGN

We used Object-Oriented Development Approach to developed MISF. In this approach, the system users are identified as "Actors," and the different functions for each user are considered "use cases". The system's input and output screens were designed and linked to the databases. The system provides the users with security options to protect their accounts. MISF was implemented to protect the privacy of the users by securing access to the system and its data. It preserves privacy for all system users by protecting their menus, privileges and accessing their data.

Design of the System

In our analysis, we used a Unified Modelling Language (UML) Use case Diagram as a preliminary step to create an overview of the system without giving more detail about the system. This diagram (Figure 2) normally consists of the overall application dataflow and functions or processes of the MISF. It contains all the users and their interaction with the system.
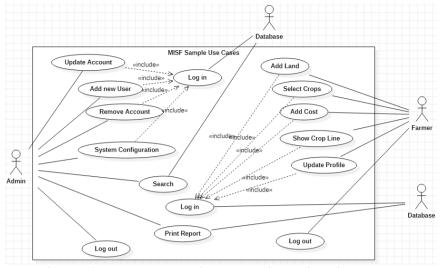
Figure 2 A sample Use Case Diagram for Farmer, Admin and Database Actors in MISF

A table containing all the database components that are part of the Market Information System for Farm reference architecture can be found in Table 2.

As shown in Table 2, we have 18 entities. The detailed data of MISF is stored in these tables. Each entity has different attributes and contains a primary key as a unique key, and may have a foreign key. The entity crops contain primary key cropID and fieldID as a foreign key. All the entities are normalized and reduce duplicity of records.

Crops (cropID, fieldID, cropPrice, cropAmount, cropUnit, cropDate, cropAdmin, cropBuy, data_in)

Based on our analysis of the system and the results of the survey, the design of the web interface is generated and includes two parts: A main screen serving the general public with general information for the different stakeholders and services listed on it, and the second part is a control panel protected by a username and password to enable administrators to carry out system related tasks. Listed here a screenshot of the main screen (Figure 3).

Table 2: Database Structure

Entity	Attributes
AccountInfo	accountInfoID, accountID, infoType, acountInfoValue, accountInfoTime,
AccountType	accountTypeID, accountAdmin, accountTypeName, accountTypeStatus accountTypeTime,
Accounts	accountID, accountType, accountName,accountLogINTime, accountStatus, accountIdCard, accountPass, cityID, addrID, accountTimeRegist, data_in,
Addr.	addrID, cityID, addrName, addrLat, addrLng
City	cityID, cityName
Crops	cropID, fieldID, cropPrice, cropAmount, cropUnit, cropDate, cropAdmin, cropBuy, data_in
Fertilizer	fertilizerID, fertilizerName, fertilizerTime, fertilizerAdmin, data_in
FieldCost	fieldCostID, fieldID, varDataID, fieldCostTime, accountID, fieldCostValue
Fields	fieldID, fieldName, accountID, varDataID, AgriType, fieldDate, fieldArea, AgriCost, fieldHarvest, fieldStatus, data_in
InfoType	infoTypeID, infoTypeName, infoTypeStatus
Msgs	msgID, msgSender, msgReceiver, msgBody, msgTime, msgStatus
News	newsID, newsType, newsTitle, newsBody, newsTime, newsImg, newsCity, newsStatus
Points	varDataID, accountID, cost,size, AddTime
RequestCrops	RcropID, cropID, RcropAmount, RTime, RacountID, FamerID, reuqestStatus, ResStatus
SystemVars	systemVarID, systemVarName, systemVarStatus, systemVarTime, systemVarAdmin
VarData	varDataID, varDataValue, varDataTime, varDataAdmin, systemVarID
Website PIC	PICID, PICName, PICCreateTime, PICSection, TextDET

Figure 3. The Homepage of the System.

Besides the functional requirements that are mentioned so far, there are several functional requirements to be addressed, such as user management, data security, or routing of information. These requirements are crucial for MISF.

System Implementation

This section describes the design and development of an agricultural market information system for the farmers in Palestine (MISF). Access to this system is provided through the Internet. The application layer protocol that is Hypertext Transfer Protocol (HTTP), is used to transmit all files (HTML files, image files, query results, etc.) on the World Wide Web. The users will be able to view the required information related to the different activities of farming.

The front-end of this system uses JQuery and HTML for its user interfaces, while the back-end uses a MySQL database to manage its data. The front-end and back-end of this system are connected using a MySQL driver. The data retrieval and update of this system are done using MySQL queries.

Since the database will require updating by non-computing proficient personals, the system provides easy access to the database for all types of data manipulation. Security of the database is ensured by the use of a password for updating purposes, which will be given to the different users of the system. The System provides the external

user the ability to obtain summarized information in a preferred format. This can be produced for certain crop types for any given year.

The set of tables is created using the relational database using MySQL for the identified entities at the design stage. The uniqueness of the data fields in these tables is established using primary keys, while the relationships are maintained using foreign keys.

Figure 3 presents the home page for our market information system, MISF. Different functions or information are chosen through a hyperlink of the main page.

Making queries for MISF can be done using specified appropriate dialog, form, edit, and list boxes. Required query statements are constructed automatically by the system, and the users need not be aware of them. The following describes a sample query statement issued for the query to show the farmer's name. Edit box options are filled and passed to the query statement using variables of the SQL language. These variables are shown in italic font style.

SELECT *accountName* FROM `accounts` where *accountID*='12123'

Users can update the database related to their farm, crops, land and other information by login to their account by specifying the username and password (Figure 4) through the web browser.

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Figure 4. Login Screen for the user

Another sample is the farmer account (Figure 5). The farmer can define what he owns of agricultural lands and determine the types of crops planted on the lands. This is in addition to scheduling dates for picking crops. During the cultivation period, the operating expenses are added to reach the harvest period to help set a minimum cost price.

The software application on smart devices allows the system user to manage all the different operations, such as following up orders and adding the number and quantity of crops from his account. In this way, the merchant can search for and make an order of an offered crops. (Figure 6).
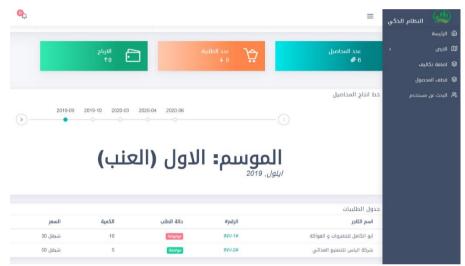

Figure 5 Main Interface for Farmer Account

Figure 6 Sample Interface for a farmer account

A static view of the runtime configuration of the processing nodes and the modules running on those nodes is illustrated in the deployment diagram. The deployment diagram in our framework shows the MISF hardware, the software that is installed on that hardware, and the middleware used to connect the various machines to each other. Figure 7 shows the deployment diagram.
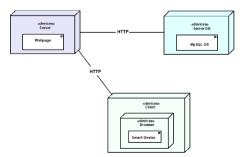

Figure 7 Deployment Diagram

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RESULTS AND DISCUSSION

The proposed system was designed to provide reasonable, technology-based solutions for the difficulties facing agriculture in Palestine. One key design objective was efficiency; it was shown in the previous studies that the Palestinian agriculture market system suffers from many problems, all because the right information is not available when needed, and the current market mechanisms are outdated. The proposed system addressed these issues directly by providing a comprehensive, modern, and efficient solution to all the stakeholders in the market. The system stores data about crops, soil, irrigation, fertilizers, weather, pesticides, etc. Then this data is analyzed to advise farmers on the most suitable crops needed in the market and provide an easy and fast way to connect buyers and sellers. The data can also be used for future research and development projects concerning the agricultural sector in partnership with the Ministry of Agriculture.

Currently, this system is available online and runs its web server on the WEB. An administrator user maintains the system, supervising the different tasks of the system and the database. The ultimate objective is to allow this system to be used by as many users as possible in the agricultural sector. Having more users in the system will make its database more valuable and efficient.

The main stages for system development can be summarized as follows:
* Creating system database to support user types, Palestinian cities, product types, …
* Adding the data for Palestinian cities and villages to be used by the system.

The different types of user accounts have been identified and created with the right permissions for each account. A control panel was created to enable the system administrator to carry out the required admin tasks.

System protection was considered during the coding of the project to preserve the data and prevent unintended use of the system. In addition, user permissions were set to determine what kind of data and tasks each user can do according to his role.

The main outcomes of this study
* Software that helps improve farmer productivity
* Technology advises for farmers

* Developing stronger relationships between farmers and consumers
* Supporting the agriculture ecosystem in Palestine.
* Opportunities and benefits to a wide range of stakeholders, from small farmers to businesses and government.
* Ability to optimize market efficiency by connecting buyers and farmers.

This research has developed a proposed architecture for the MISF to contribute to the agriculture sector. This architecture can be used to map, plan, design, and implement a real farmer's market information system that meets the requirements set out in this study.

MISF suits the different stakeholders' needs, including an easy adaptation, user-friendliness, and accuracy in depicting the various production processes, management, and services.

The focus of MISF is to perform farm activities based on all farm transactions. Different users or stakeholders in the agricultural sectors can use the system. The application was successfully implemented using web technology and smart devices and tested where all different scenarios were recorded.

The evaluation of the proposed architecture contains two parts. First, the proposed architecture was verified based on the requirements. Second, a conceptual validation that maps the functionality of the proposed architecture was tested using two applications. These applications are based on web bases and smartphones.

CONCLUSION

This work is an initial study to show that the creation of a Market Information System for Farmers is feasible. The real benefits of this type of information system to the agricultural sector in Palestine can be seen when it becomes operational for all stakeholders: Farmer, agricultural trader, agriculture production factory, Ministry of Agriculture, agriculture directorate, and agricultural supplies selling points. This system will promote more hope for importers, exporters, and researchers who will access the updated information.

The main importance of the system is providing information on what agricultural

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products are in demand by analyzing consumer consumption and market trends using Data Mining techniques. With this information, farmers would have a better idea of what crops to prioritize. This can also help stabilize the economic sustainability of farming by improving farm management. With the system at work, it will reduce oversupply and undersupply of certain agricultural products, and the stable supply-demand relationship will prevent the underpricing of agricultural products and help in stabilizing market prices.

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