



SAMAKA: A Proposed Model for Fish Market Management System (FMMS) Supported by WikiFish Mobile Application

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Abstract:

Fish market in Gaza play an important role in the income of the total local market and the local GDP, and a lot of families' income depends mainly on the fisheries sector. In the other side, local aquaculture sector also contributes to the market. A significant quantity of both aquaculture and fisheries production is exported outside Gaza to West bank. The fish auction which is held every day is monitored by the ministry of agriculture, and a broker manages the auction. The fishery sector, including catching and farm fish, from fishing to vending in the market, suffer a lot of difficulties and problems related to the supervision and monitoring because there is not a platform to automate all processes. These processes need to be controlled and monitored by a management system.

Our proposed fish market management system (FMMS) connects all stakeholders of the fish market: fishermen, ministry of aquaculture, aquaculture farms, traders, restaurants, and exporters. Moreover, the ministry of Health can record their monitoring related healthy and quality information on the system. The customer in the other side can use the WikiFish mobile application to enquire about any information related to any fish species: its source, quantities in the market, prices, types, etc. by scanning fish image; the application is supported by image processing and Artificial Neural Network (ANN) algorithms to train the system.

The system will manage the data of the fisheries sector effectively, and its impact will be obvious by improving the customer's overall experience by better managing interactions, from sales to customer service and marketing, therefore, determine productivity, fidelity, and overall success.

Keywords:

Fish market, management system, economy, fish recognition, image processing, ANN.

1. Introduction

Fish is the main source of protein, micronutrients, and the essential fatty acids that provide diversity nutrition to Gaza Strip residents. As Gaza is a coastal region, nearly 18,000 people rely on fishing for their income despite all the restrictions, and the amount of catching increased as the permitted access region in the sea increased [1]. Also, they mentioned that in 2019 the catching amount has increased by 34% compared to the same period in 2018 which indicate how it is important to care about this sector as one of the main economical Palestinian sectors. The exportation of fish that include caught fish and farm fish has increased recently also by 85% compared to the same period in 2018 as mentioned in Figure 1.

The fishery sector including catching and farm fish suffer a lot of difficulties and problems related to the supervision and monitoring. For example, landed fish is suffering from the presence of irregular inspection of fish as well as inaccuracy on the volume and the landed species. The monitoring system is also not publicly available for policymakers and researchers. There is no information system to record all fishing related data and to extract reports about any process. The data, the statistics and pricing mechanisms of the fish through the auction market are not efficient to reflect the true value of the landed fish and it may not reflect the supply and demand forces [2]. If the customer needs to know the fish market status, he cannot find any source for this information either for the available species or prices. Furthermore; farms work separately and do not share information with the other entities in the market. To conclude the

previous shortcomings, the fisheries sector need an information system to manage and monitor all daily operations between all stakeholders and to provide accurate daily information for customers.

Other countries such as India [3], Bangladesh [4], and Sri Lanka [5] which are famous with the fisheries sector, suffer from the complex market ecosystem without computerized information system to support all market processes, so fish market specialists recommended developing and adopting efficient fish marketing system to increasing the productivity of fisheries and making certain their livelihood security.

The main contribution of our proposed model is providing Samaka system that consists of two main subsystems, a Fish Market Management System (FMMS) integrated with a WikiFish mobile application. The proposed model will provide a solution to the mentioned problems and will provide the authority with a complete platform to manage all sector data.

Our paper consists of four main sections. In the next section, we will explore the related work which is rarely available in the same sector. Then, the proposed system is explained and its impact on the economy, in case of adopting it, is described. Finally, a brief conclusion is presented.

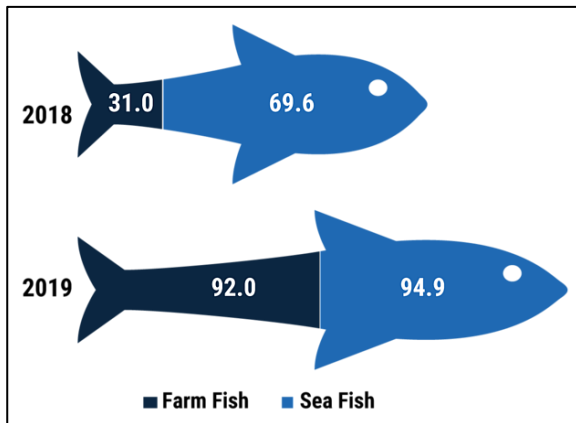


Figure 1: External Trade of Fish from Gaza by Type (in Tons) | 2018 - September 2019. Source: Palestinian MoA

2. Related Work

Existence of a market management system and structure is one of the main circumstances of socio-economic condition of the local people and the production system of any area. With a connection from the production sector to the consumer sector, it is a chain of various systems involved in the market. As fish and fishery products are highly traded supplies, fish production is a necessary part of the marketing process to make a whole complete.

Most of the researches show the current state of fish industry and how the fish ecosystem works, almost no proposals are presented to provide information system platform solution to help the fishermen and the consumers. One of the most important experiences in managing the fish market is in Bangladesh. Bangladesh is ranked the 5th in aquaculture production worldwide where the fisheries sector contributes 3.65% of total GDP and 23.81% of the agricultural, and 13.86 million people are fish farmers. So, researchers proposed a digital platform to increase the profit earned by the fishermen, while providing fresh fishes to the consumers at a lower price than the market by controlling middlemen in marketing chain [6]. In our proposed system we consider all stakeholders of the fish ecosystem providing various services while in [6] they consider just two types of users the fishermen and the consumers because they care only about the price.

Some projects were developed to use the technology in the field of aquaculture such as the Allocated Zones for Aquaculture (AZAs) [7] which is a coastal zone where aquaculture development has priority over other uses; they developed the AZA toolkit that aims to provide information on the processes, benefits and management of AZAs. The toolkit offers information on general and specific concepts, and its contents are tailored to the specificity of the Mediterranean and the Black Sea basins. It is composed of some factsheets such as aquaculture definition and stages of production, floating cages for finfish farming,

species reared, environmental monitoring program, sustainability indicators to assess aquaculture development. It is not related to market management or the whole ecosystem.

The European Aquaculture Technology and Innovation Platform [8] is another valuable project to share information among the European aquaculture sector, it is a network to distribute knowledge and doesn't support market management daily data.

Chuenpagdee *et. al* 2019, has developed the Information System on Small-scale Fisheries (ISSF) because there is a standardized reporting system to collect data about fisheries sector, it is a Web-based, open data portal to collect and disseminate knowledge about SSF, their system provides reports about location-based information around the world, it is not specific with a special area or country and it doesn't focus on the fish market [9].

3. The Proposed System

The proposed system (Samaka) is designed to satisfy all fish ecosystem stakeholders' requirements, starting from the fishing process to the customers, and managing all the processes of the related organizations (Figure 2). It focuses on the current Gaza Strip market where fishermen fish, clean and sort the fish before taking it to the auction. The auction is managed by a broker and supervised by the ministry of agriculture and the ministry of health. The market can be individual customers, restaurants, traders, or fish seller. Moreover, aquacultures farms, that are supplying the market with special types of fish, are considered in the ecosystem.

3.1. System Architecture

The Samaka system consists of two main applications (Figure 3):

- *Fish Market Management System (FMMS)*: it is a system that manages all fish market-related data, and administered by the policy-making institution such as the ministry of agriculture. It collects the main daily data from fisheries, ministry of health, farms, and provides information to all parties about the current status of the market. Besides, indicators about the quantities and prices will be available.
- *WiKiFish*: It is a fish Wikipedia mobile application for any user who needs information about any fish type; the user can search by scanning fish photo or by fish name. It includes a database of all available fish in Gaza Sea which is recorded during years ago by the General Directorate of Fisheries in the ministry of aquaculture.

3.2. Process of Communication

In this section, relations between entities of the system will be explained. The FMMS is connected to the WiKiFish, because the user can inquire about available fish in the market with daily prices and points of sale.

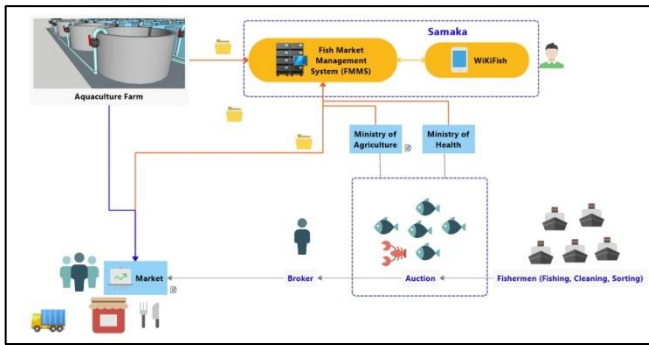


Figure 2: The proposed fish market ecosystem in Gaza Strip

3.2.1. FMMS

The FMMS is the core system that includes all the database of the fish market ecosystem and receives information from all stakeholders. The main entities that provide the system with daily information about the fish market (Figure 2):

1. *Fishermen*: They use the system to submit daily fishing information such as quantities and types of fishes.
2. *Ministry of Agriculture* represented by the General Directorate of Fisheries: it monitors the auction, records the following information (species, quantities of fishing, size, vessels, nets, location, and depth).
3. *Ministry of Health*: monitor the fish if it is suitable for human consumption and there is not any dangerous type.
4. *Aquaculture Farms*: Record data of fish supplied to markets and restaurants, they can use the system to inform about the fishing production and estimate the needed quantity of farm fish.
5. *Market*
 - a. *Traders (Fish Seller)*: they can get information about the daily fishing production and reserve the fish they need, in the other side each seller provide the system with current fish available in his shop, this will help individuals to know the nearest one to their location to buy fish.
 - b. *Exporters*: exported fish and the exporters should record all information related to the fish exportation to balance between local market needs and the exported fish.
 - c. *Restaurants*: they can get any information about the daily fish available in the market and their prices. Also, they can order and buy online.
 - d. *Individuals*: they will use the WikiFish mobile application.

The user must have a user name and password with permissions to access the system while individuals who use Wikifish can use it without access restrictions.

Figure 4 shows the entity-relationship diagram of all ecosystem entities, it describes the relation between entities, information exchanged between them, user types, and all processes.



Figure 3: Main UI of Samaka System

3.2.2. WikiFish

The WikiFish is a fish encyclopedia android mobile application supported by an image processing algorithm to recognize the type of fish by capturing a photo by the user smartphone camera.

The ability to recognize fish species and their type is an important component for the application. In this work, we present the application of deep convolutional neural networks to the classification and recognition of fish images. We use the AlexNet deep Convolutional Neural Network (CNN) algorithm [10] to get the best results and all algorithms are under testing now. This algorithm was used by another project for the classification of maritime vessels [11].

We provide the system with 89 images for local sea fish species of Gaza Strip, the images are processed, enhanced, filtered, and normalized to be ready for the algorithm. Also, fish image is separated into three main parts: fish head, fish body, and tail to increase the precision of the recognition results.

Using the WikiFish, the customer can go to the market, take a photo by a mobile camera for any fish (Figure 5), and ask the app to provide information about this fish. After recognizing the fish (Figure 6), the system show fish information (Figure 7) such as the name, description, max length, min length, max depth, other types of the same family...etc.

The second option for the customer is to search by name. By this method, the system will show any fish type related to the search info then the customer can select the best one fit to his search.

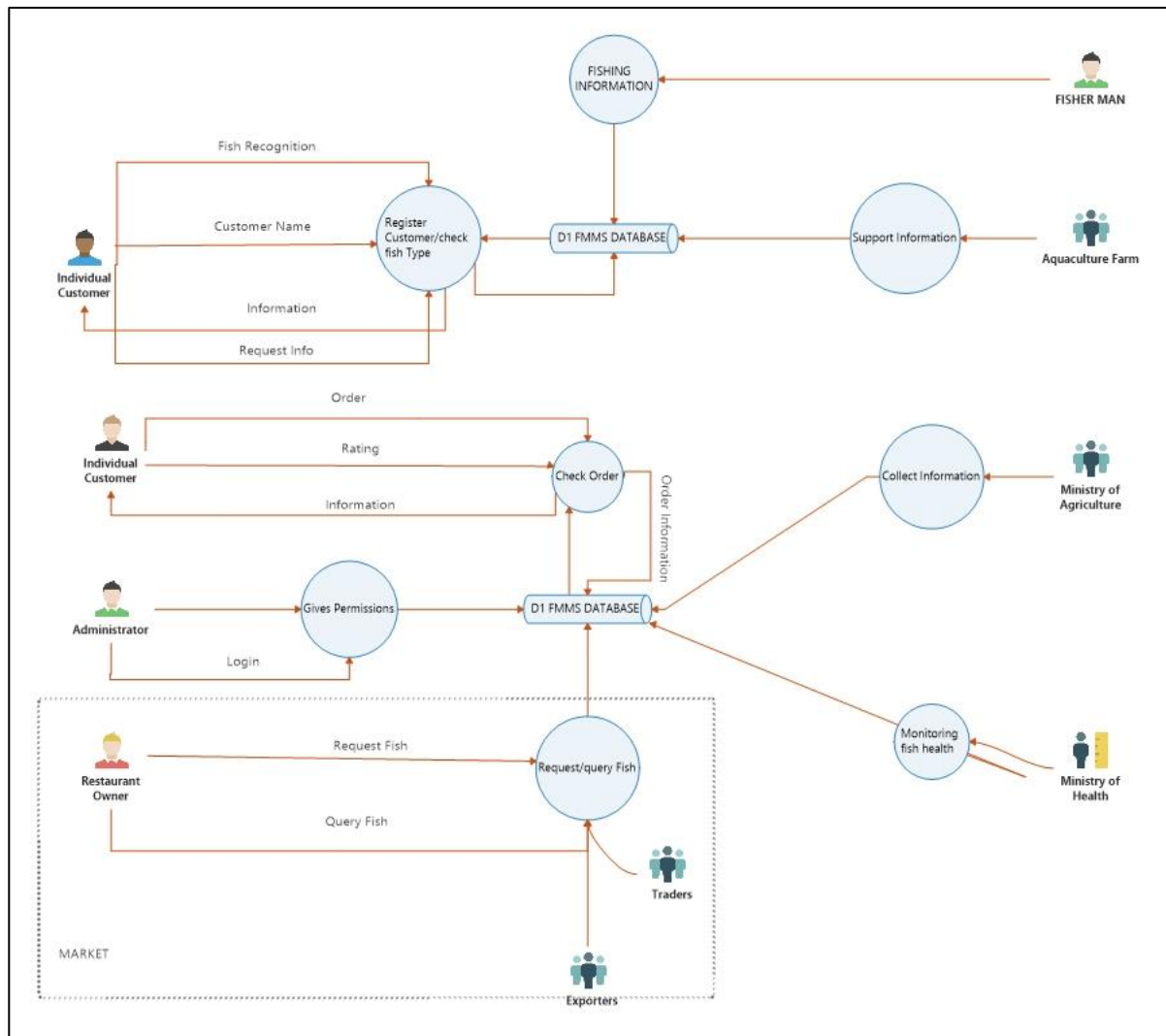


Figure 4: FMMS Entity relationship diagram

4. Impact on fish ecosystem

The use of the fisheries information management system in Gaza Strip is a qualitative advancement in this sector and will lead to great development in the management of this ecosystem that suffers from a lack of information management to help in monitoring and following up daily data and operations related to the fisheries and aquaculture. It will consider health and quality control, as well as management of fish market prices and ease of access for the consumer. The system will balance

between the quantities of fish caught and the quantities supplied from farms to sellers. The consumer will also be able to get daily info about fish market status and determine the types of fish, the points of sale, and their prices through the application. There is no doubt that the application of the proposed model will also facilitate all authorities such as the ministry of agriculture to obtain periodic reports on the status of the fisheries sector, whether on a daily, monthly or yearly basis. This will help them to set strategic plans and develop this sector based on real documented data.



Figure 5: Scan Fish by WikiFish Mobile App

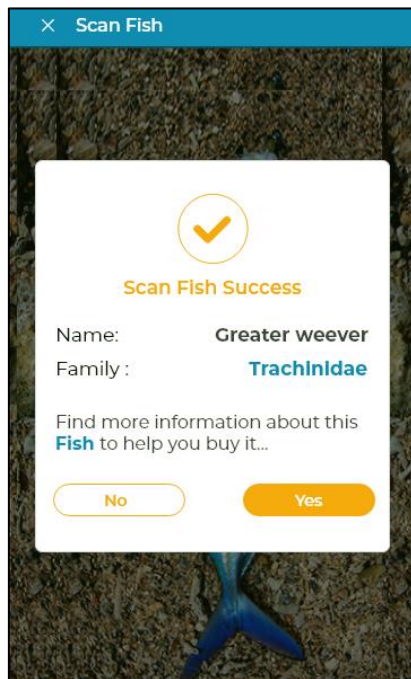


Figure 6: interface when fish scanning success

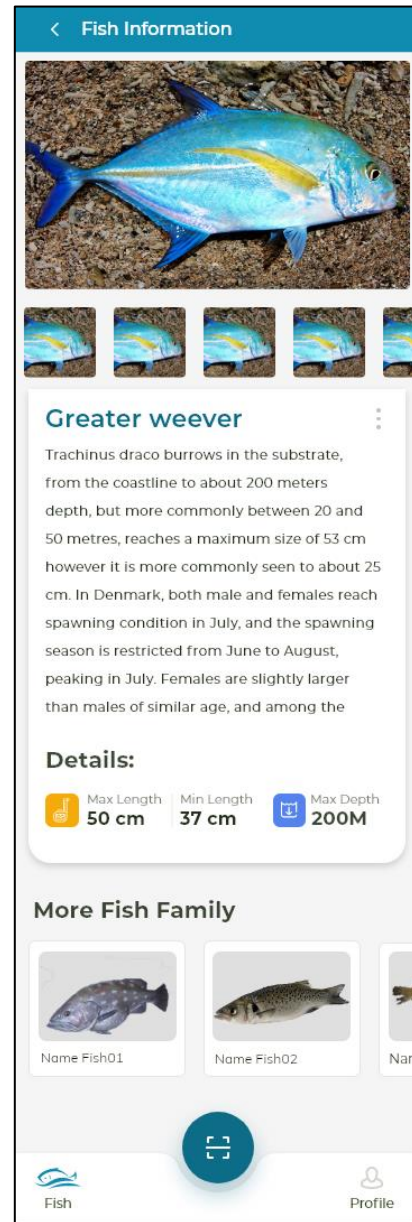


Figure 7: Fish information

5. Conclusion

The proposed system will help in controlling the fish ecosystem, controlling the fish quality and health, and finally facilitate the consumer to find and purchase a good fish production in specific location and estimated price. The application will help in the identification of fish species and minimize cheating and increase consumer reliability. The application will benefit all stockholder including researchers who encourage investigating related work to better and complete control of the fish market.



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