



**Faculty of Information and Communication Technology**

**REAL ESTATE RECOMMENDER SYSTEMS USING CASE-BASED  
REASONING APPROACH**

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**Master of Computer Science in Internetworking Technology**

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**REAL ESTATE RECOMMENDER SYSTEMS USING CASE-BASED REASONING  
APPROACH**

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## **ABSTRACT**

The huge amount of data available on the Internet has lead to the development of online systems. This project proposes a Real Estate Recommender System using Case-Based Reasoning Approach which can help the customer to find a desired property. This proposed system uses a recommendation approach during search for property which assists the users to find an appropriate property and make decisions where they need the required knowledge to judge a particular property. Furthermore information available is very huge, so the recommender system assists the user to filter the available dataset according to user needs. Recommendation methods used for the search engine is Case-Based reasoning approach which can solve a new problem by retrieving the same problem that has been solved before and reuse the information that used to solve this new problem. Also the system uses collaborative filtering approach which filters the properties based on other user rating for properties; the system will do recommendation based on the top rated properties. In addition the system will recommend the user based on the most visited properties, where the system will count the number of visit to the database, and then based on the property with highest number of visit system will recommend the appropriate property to the users.

## **ABSTRAK**

Jumlah besar data yang terdapat di Internet telah membawa kepada pembangunan sistem dalam talian. Projek ini mencadangkan satu Sistem Penentu Hartatanah yang boleh membantu pelanggan untuk mencari harta yang dikehendaki. Sistem yang dicadangkan menggunakan pendekatan cadangan semasa mencari harta yang membantu pengguna untuk mencari harta yang sesuai dan membuat keputusan di mana mereka memerlukan pengetahuan yang diperlukan untuk menilai satu hartanah. Tambahan pula maklumat yang ada adalah sangat besar, jadi sistem Penentu yang membantu pengguna untuk menapis dataset yang ada mengikut keperluan pengguna. Kaedah cadangan digunakan untuk enjin carian adalah Kes Berasaskan Hujahan pendekatan yang boleh menyelesaikan masalah baru dengan mendapatkan semula masalah yang sama yang telah diselesaikan sebelum dan menggunakan semula maklumat yang digunakan untuk menyelesaikan masalah baru ini. Juga sistem ini menggunakan pendekatan kerjasama penapisan yang menapis ciri-ciri berdasarkan penarafan pengguna lain untuk hartanah; sistem akan melakukan cadangan berdasarkan sifat-sifat tertinggi atas. Selain itu sistem akan mengesyorkan pengguna berdasarkan sifat-sifat yang paling banyak dikunjungi, di mana sistem akan mengira bilangan lawatan ke pangkalan data, dan kemudian berdasarkan hartanah tersebut untuk jumlah tertinggi sistem lawatan akan mengesyorkan harta yang sesuai untuk pengguna.

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## DECLARATION

I declare that this thesis entitled “Real Estate Recommender Systems using Case-Based Reasoning Approach” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : Ebrahim Mohammed Abdo Alrawhani

Date : .....

## **APPROVAL**

I hereby declare that I have read through this project report and in my opinion this project report is sufficient in terms of scope and quality for the award of the degree of Master of Computer Science in Internetworking Technology.

Signature : .....

Name : DR. HALIZAH BT. BASIRON

Date : .....

## DEDICATION

*This paper is dedicated to Allah Subhanahu wa Ta`aalaah Whose guidance, help and grace was instrumental in making this humble work a reality.*

&

*To My Family who support me all my life*

*And*

*To all loved ones whom love me dearly.*

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# CHAPTER 1

## INTRODUCTION

### 1.0 Overview

In survey conducted by The American National Association of Realtors (NAR) in 2011 (Veissi, Thomas, Mendenhall & Hepp, 2011), result of the survey shows that most of the homebuyers prefer internet when searching for home or any property. In last survey conducted in 2013 by The American National Association of Realtors show that the search for home in the Internet increased to 92% (Thomas, 2013) compared to 88% in 2011.

Real Estate systems have been expanded recently, generally each company built its own website to advertise its products and perform online buying and selling. Therefore, consumers can get lost in searching among those all websites and it became more conflict and time consuming. For that reason, building Real Estate Recommender System using Case-Based Reasoning Approach to be used as base for many user of one product became more desirable.

Recommendation systems assist the user to get the information that required and help him to make decision. Although the database for system can be huge and it will take time to get the information, the recommendation systems here assist the user to filter the information according to users' needs (Athalye, 2013).

## 1.1 Project Description

People these days tend to invest in a business not only to obtain profit, but also knowledge and expertise. In order to meet the demands of customers, a company must sell the product that they really want or need. Real Estate Recommender System using Case-Based Reasoning Approach is a perfect example. The system will act as the mediator between buyer and seller. In addition to the system concept will be categorized, such as houses, apartment and shop). Recommendation system will help the user to make the decision; therefore, the user can easily go through and find their wants based on their needs.

Moreover there will be some detail for each property so that the buyers will get enough information before purchasing. Furthermore the sellers can also perform some kind of advertisement in the website such that announcing for new property.

Nowadays by looking at what both the buyers and sellers of real estate really want, there lies another business opportunity within a medium or a platform where sellers post their sales or offers and buyers get to choose what they prefer to purchase. This is where technology fills in that gap of shortage of demand and supply within the Real Estate market. By creating an evolutionary automated Online System that uses the world wide web to connect anyone that seeks to buy, lease or even rent a piece of land would set it as an essential tool to both the Seller and the buyer of a real estate.

Therefore, the aim of this project is to build a Real Estate Recommender System and implement recommendation approaches such as a Case-Based Reasoning approach for the search engine which provides searching process to assist the customers in finding their needs, and collaborative filtering which recommend user based on other user preference of interest.

## **1.2 Problem Statement**

As the result of the growth in number of real estate property suppliers which almost each one has its own website. Most consumers if not all maybe aware of the specific real estate company or agent website, hence this can be time consuming for them to search the internet or information about the property they are interested to buy/purchase. And the search in these websites doesn't benefit the buyer in term of search time flexibility, and intuitive result. These websites still ask buyer to search more to get the result needed, where it's a waste of more time and energy.

To avoid the traditional search engine, we will develop Real Estate recommender system and implementing case-based reasoning approach for the search engine which will improve the recommendation accuracy during search for a property. Also we will be implementing Collaborative filtering approach which will recommend properties to the buyer based on the top rated property by other users.

## **1.3 Research Questions**

Based on the problem statements as stated in an earlier section, the research question of this study are as follows:

1. How to build a recommender system that assist users to sale/find a property?
2. How to develop recommendation approach for the system search engine?

## 1.4 Research Objectives

There are several objectives to be achieved in term of achieving the purpose of this project. Below is the list of the objectives:

- To develop a Real Estate recommender system.
- To apply recommendation approach for the search engine using Case-Based Reasoning approach.
- To apply Collaborative filtering approach to recommend users based on most rated property.

## 1.5 Project Scope

The scope of the project is to develop a Real Estate Recommender System using Case-Based Reasoning Approach that enable users to sell their property or to buy a new property with functionalities and services that make their real estate marketing much easier and more facilitated. Real Estate Recommender System using Case-Based Reasoning Approach will carry out many tasks.

- **User Modules**

That mainly contain sub modules such a user registration, user login, and User profile, etc

- User registration, in this module the user who wants to be member will key in his personal details such as, name, job, address, password etc.

- User Login is a function that allows the user of the system to login to their account. The system should be able to check whether this user is already registered or not. If the user is already registered then all the privileges of the system will be visible.
- User profile contains all the personal information about the member. The member can edit his profile using update profile function for example the user can edit his password, address, email, contact number, zip code, etc.

- **Search engine:**

Search engine can be used by the buyer to find his preferred property, Improve the efficiency of search engine using recommendation system for real estate website, using case-based reasoning (CBR), This function is used by buyer to search based on their needs and reduce the time consuming for searching in different websites. Also we use collaborative filtering which can recommend properties to the user based on other users interest, with top rated properties; furthermore system will recommend users with most visited properties by user.

- **Post Advertisement:**

This function allows the sellers to post their properties in the system. The sellers will be able to edit or delete the advertisement whenever they want.

- **Administrator:**

Fundamentally will be backend where the admin is to control and make maintenance of the system; the admin will be able to show the existed users, properties

etc. Moreover, the admin will have the privileges such as (adding and deleting users, adding property and staff).

## **1.6 Target Users**

The System will be used by three types of users:

- **Administrator**

Admin is the one who can monitor the system and also is the one who has a physical access to the database. The main role for the admin is to configure the control panel of the system like approving a new user registration. Furthermore Admin is able to access to users profile to view and email them. Admin can view the sellers or member of the system where he can also block anyone of them, also admin can view and delete properties added to the system and admin can view property chart. In addition admin can view message sent by users and reply to these messages. Also admin has the ability to add another admin or staff that can monitor the system. Furthermore Admin is able to add new seller to the system.

- **Buyers**

A Buyer can browse the system to get some information about the system and the way to search for a property. Buyer doesn't need to register in the system to search for property. Basically can browse and search for the desired property. Also Buyer has the ability to email admin regarding any problem they face in the system. Furthermore buyers can check availability of the property he/she prefers by filling his details.

- **Sellers**

Seller has the ability to post a property he would like to sell/rent. For the seller to be able to add a property, seller needs to register to the system and confirm the registration by Email. Seller is able to check properties orders sent by buyers to check if property still available, then seller can reply to these orders. Seller also can view their profile and updated their information. Seller can email the admin if any problem faced during property post or any other system function

## **1.7 Organization of the Thesis**

This Master project report consists of six chapters, structured as follow:

### **Chapter 1: Introduction**

Chapter one the first chapter of this Master project thesis, it contain overview of the project, project description, problem definition, research questions, project objective and scope of the project.

### **Chapter 2: Literature Review**

In first part of the Literature review we give a description the recommendation system on real estate, then we listed and describe the methods of recommender system used nowadays, and we describe in details the method we choose for recommendation in our system, first method is the Case-Based reasoning approach and its characteristics and the cycle of the Case-based

reasoning. The second method is the collaborative filtering approach which depends in user rating or interest of an item. Then we propose method based on the most visited properties.

The second part of this chapter we look at three existing websites, Amazon.com, apartment.com and Tripbase.com as related work to know how these websites use recommendation system, and we give a short description of the features of these two websites in order to know the recommendation approach used in these websites. In the last part of this chapter we give survey analysis of implement real estate recommender system, and all the statistical data are explained and demonstrated in details.

### **Chapter 3: Research Methodology**

This chapter discusses the methodology used to develop the system which is System Development Life Cycle (SDLC) method which is mostly used for software development.

### **Chapter 4: Proposed Solution and Implementation Plan / Design**

In the first part of this chapter, we proposed system solution; this solution is based on the user requirements in data collected from the survey. The proposed solutions is implemented via combination of using three method for recommending the user or the buyer of the property, first method is the case-based reasoning approach, the second approach is collaborative filtering, the third approach I can call it the most visited approach, we will explain each approach in details. The description of these approaches is supported with diagrams to ease the understanding how these approaches work.

In second part of this chapter, we discuss in details the design and development of the system. It explains on the requirements determination and structuring activity as well as production of system design according to the functional requirements. And we show by diagram the system structure, also system requirement explained in details, further more the database requirement described in details with diagrams needed such as ( ERD diagram, use case diagram and sequence diagram), it explains on the requirements determination and structuring activity as well as production of system design according to the functional requirements. Finally we describe Interface design by provide system screen shots and we describe how the system works and we give description of the system function such as (how the recommendation approach works and the user can post property in the system, etc), we also give a description the work of each user in the system such as (Admin, Seller and Buyer).

## **Chapter 5: System Testing**

In this Chapter system testing for has been clarified and gave the correct and expected outputs. The links has been tested too. The target test plan will focus on the finalized prototype of the system. The test plans involve Function Testing, Database Integrity Testing, User Interface Testing and Security.

## **Chapter 6: Conclusion and Future Work**

In this chapter we give a conclusion of work which a short description of what we did and what is the method used during implementation of the system. Then we explain the future work which will be done to improve the system with future technology. And what we propose for the future.

## **CHAPTER 2**

### **LITERATURE REVIEW**

The E-commerce industry has a quickly increasing phenomenon, which is grabbing hold of all types of companies and businesses. Along with the World Wide Web and Internet, online shopping and purchasing is become a regular habit in today's society, however with more and more people purchasing goods and services online. There are several websites that perform a mediator between buyers and sellers. People, who would like to sell real estate, interact with the new area of technology and seek a target to deliver their properties of real estate marketing through the online websites for the customers in the world.

The first part of this literature review will illustrate general description of recommendation system and recommender systems method used today discuss how the Case-based Reasoning approach is working and the characteristic of Case-Based reasoning. And explain in details the collaborative filtering approach which will be used to develop the system. The second part of this literature review will illustrate the related work uses recommendation system; we take three of the existing online systems and find how the recommendation systems work for these two online systems and what recommendation approach they use. These systems are Amazon.com, Tripbase.com and apartment.com. The last part of this literature review is the survey data, which is analyzed and described in details.