

Agent

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Submission date: 23-Sep-2024 09:11AM (UTC+0600)

Submission ID: 2462407424

File name: Tentua_2020_IOP_Conf._Ser._Mater._Sci._Eng._835_012039.pdf (441.7K)

Word count: 2915

Character count: 15958

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To cite this article: Meilany Nonsi Tentua *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **835** 012039

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The Multi Agent System for Job Recommendation

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Abstract. The number of available job portals causes abundant information. Therefore, a system of recommendations is needed by job seekers to find jobs that fit their profile. Offering job vacancies on job portals are changing every time because there are always additional job search data and job opening data. Multi-agents system is a technology that can be used to handle information changes. This article proposed a recommendation system is expected to help job seekers to get jobs in accordance with the field of science they have. The system will monitor what work is offered by online job portals. From the results of observations, the job content offered will be used as a reference so that if new content is entered, the agent will automatically provide input to the job seeker. Based on the results of the implementation of the recommendation system using a multi-agent system can provide search results that are in accordance with what is inputted by the user based on the profile they have. These search results can recommend jobs that match the job seeker profile.

1. Introduction

Today, there are many portals that offer online job openings (Job Portal) in Indonesia, such as Indeed.com, Jobindo.com, karir.com, loker.id and kompaskarir.com. Job portal provides job search features based on position, company name, job location and salary amount. The online job portal application allows job seekers and recruiters to be directly connected [1].

The number of available job portals causes abundant information. This often causes job seekers to get confused and eventually take jobs that are not in accordance with their profile. Therefore, a system of recommendations is needed by job seekers to find jobs that fit their profile. The recommendation system also helps people to find interesting items by utilizing previous user interactions [2]. In addition, the recommendation system has a successful use in e-commerce applications to handle problems related to information overload efficiently [3].

Offering job vacancies on job portals are changing every time because there are always additional job search data and job opening data. So that for job recommendation systems must contain technology that can adapt to changes in the environment in the system. In addition, the recommendation system must also be able to gather information from several existing job portals. Multi-agents system is a technology that can be used to handle information changes. An agent is a computer system, which is in a certain environment, which is capable of performing autonomous actions that are flexible, in order to meet the design goals [4]. Multi-agent system has been widely applied in several applications such as job search agencies[5], health care [6], biomedical [7], and so on. In this paper, a system of



recommendations for finding a job using a multi-agent system will be proposed. This job recommendation system platform uses agent technology, its JADE.

2. Literature Review

2.1. Recommendation System

The recommendation system is an information filtering system that handles the problem of information overload [8] [8] by filtering fragments of information from a large number of data dynamically information generated according to user preferences, interests, or observed behavior about items [9] [9].

Several methods have been applied by previous researchers about recommendation systems such as profile matching [10] [11], collaborative filtering [12] [13] [14], clustering [15], decision tree [16], [16], classification [17], machine learning [18], content base [19], hybrid [20]

Basically, the methods in the recommendation system can be divided into three categories: content-based, collaborative filtering and hybrid models. The recommendation system based on content uses items that interact with users in the past, then calculates similarity scores between pairs of items and ranks new recommendations accordingly [21]. The collaborative filtering approach suggests items to certain users, who interact with other users who have positive interactions [12]. Hybrid method is a method which combines both techniques [22].

2.2. Multi-Agent System

Multi-agents system is a technology that can be used to handle information changes. An agent is a computer system, which is in a certain environment, which is capable of performing autonomous actions that are flexible, in order to meet the design goals [4].

Several characteristics of multi agent systems can be used for the purpose of this study

- Autonomy, that is, agents can carry out independent and indirect tasks by users, other agents or by the environment.
- Intelligence, Reasoning, and Learning: Every agent must have a minimum standard to be called an agent, namely intelligence (intelligence). In the concept of intelligence, there are three components that must be possessed: an internal knowledge base, the ability to reason based on the knowledge base that is owned, and the ability to learn to complete in a changing environment.
- Mobility and Stationery: specifically for mobile agents, he must have the ability to represent the characteristics he has is mobility. In contrast to stationary agents. However, it still must have the ability to send messages and communicate with other agents.
- Delegation: In accordance with the appearance and we have discussed in the resolution section, the agent moves in a move task that is ordered by the user. This phenomenon of delegation (delegation) is the main characteristic of a program called an agent.
- Reactivity: Another characteristic agent is the ability to be able to quickly with the help of changing information in the environment (environment). Environments that can include: other agents, users, outside information, etc.
- Proactive and Target Oriented: Proactive nature is arguably a continuation of reactivity. Agents are not only required to change the environment, but also must take step by step what to take. For this reason, the agent must be designed to have a clear goal (goal), and to always be oriented towards the goals it is carrying out (goal oriented).
- Communication and Coordination Ability: Agents have the ability to communicate with users and other agents. To be able to coordinate with other agents in carrying out tasks, standard languages are needed to communicate, such as Knowledge Queries and Language Manipulation (KQML) and Knowledge Interchange Format (KIF).

The use of multi-agents on the recommendation system has been done a lot before. A multi-agent is used in the TV recommendation system based on the user's desire to select thousands of TV programs broadcasted by hundreds of TV stations [23] [24]. News recommendations that use a multi-agent framework by utilizing Social Media Preferences [25].

3. Methodology

Based on the explanation above to overcome the problem, the researcher proposes a multi-agent system for job recommendations that are in accordance with the field of job seekers. An agent is a computer system that is in an environment and has the ability to act autonomously in the environmental situation in accordance with the objectives designed [4].

The system is used to recommend work in accordance with the field of science that has been taken by job seekers. The system will monitor what work is offered by online job portals. From the results of observations, the job content offered will be used as a reference so that if new content is entered, the agent will automatically provide input to the job seeker. This proposed system is expected to help job seekers to get jobs in accordance with the field of science they have.

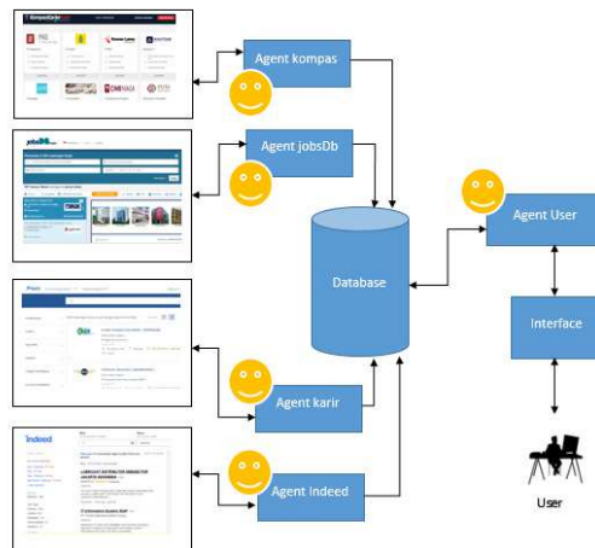


Figure 1 . Agent Work Flow Chart

Figure 1. Shows agent workflows in this job recommendation system. On the basis of this system the agent is grouped into two criteria based on its function, namely:

- information gathering agent
This agent serves to collect information from various job portals currently available, such as indeed.com, jobsdb.com, karir.com, etc.
- agent user
This agent serves to search for job openings that have been collected in the database based on user profiles

Any changes that occur in the environment will also result in changes to the agent's actions. The environment used is an online job portal on the internet. If there is a change in the portal, it will give an impact on the system agent. This environment will be modeled into a database that will be updated based on updates that occur in online portal jobs.

4. Implementation

The implementation of the job recommendation system based on the design consists of two interfaces, an interface for the user and an interface for displaying search results.

4.1. a. User interface

The user will enter the name, status, and profile. After that when the user clicks ok, the agent will search for the appropriate profile in the database.

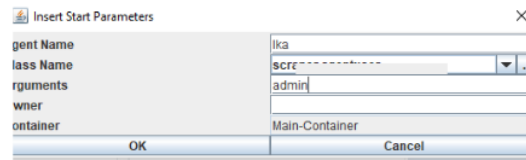


Figure 2. User interface

4.2. b. Interface results

The results of the search request performed by the user will be displayed on the results interface. The results displayed are the name of the appropriate job and the name of the company offering the job.

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Nama : PT Surya Akapindo Semarang +13 lokasi
Pekerjaan : Staff Administrasi Pembukuan

Nama : SG Yogyakarta Yogyakarta
Pekerjaan : Admin

Nama : PT. Central Prima Kelola - Central Park Mall Jakarta
Pekerjaan : Admin Engineering / Data Entry

Nama : PT Indoreksa Lokamandiri Jakarta
Pekerjaan : Service Engineer Admin

Nama : PT. Asuransi Sinar Mas Yogyakarta Yogyakarta
Pekerjaan : Admin Klerikal

Nama : PT Sumber Daya Bergengsi Indonesia +20 lokasi
Pekerjaan : Staff Administrasi
    
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Figure 3. Interface Results

5. Discussion

The online job portal application allows job seekers and recruiters to be directly connected. The number of available job portals causes abundant information. This often causes job seekers to get confused and eventually take jobs that are not by their profile. Utilization of the multi-agent system in the job recommendation system created can gather all job information offered by all online job portals. The same work from several portals will be sorted and only displayed once. So the user will not be offered repeatedly. In the system that has been created, data is collected from several online job portals such as, indeed.com, jobsdb.com, karir.com. Job data collection on the online job portal is done by the agent and then collected in one table. The results of data collection job can be seen in Figure 4.

id	name_job	company
30	ADMIN OFFICER	Angkasa Pura Supports Semarang
31	administrasi pembayaran	PT PELANGI FORTUNA GLOBAL Salatiga
32	Admin	SG Yogyakarta Yogyakarta
33	Recruitment Officer (RO)	PT. Ponseljobs Indonesia Jakarta
34	Staff Analis	SG Yogyakarta Yogyakarta
35	MAGANG DATA ENTRY	PT PELAYARAN TEMPURAN EMAS 4 ulasan Surabaya
36	Staff Administrasi Pembukuan	PT Surya Akapindo Semarang +13 lokasi
37	Cleaning Service OB Office Boy Asisten Masak	PT. Olala Trading International Jakarta
38	Data Entry Team	PT Surya Akapindo Jakarta +13 lokasi
39	Salesman/Salesgirl Otomotif (Surabaya dan Sekitarn...	PT Mobilkamu Group Indonesia Sidoarjo
40	Sales Executive (Mojokerto)	PT Mobilkamu Group Indonesia Mojokerto
41	Marketing Otomotif	PT Mobilkamu Group Indonesia Gresik
42	Marketing Mobil Baru All Brand	PT Mobilkamu Group Indonesia Mojokerto

Figure 4. Collecting data

Each online job portal has a different presentation in providing information, even from the same company. So that in this system each online job portal has one agent to retrieve information. Retrieval of information tailored to the needs of the system, so that it can be put together in the table. By utilizing the characteristics of the autonomous agent, the agent is assigned to retrieve job information every time there is a change in the online job portal

On the user side, the system will provide information about what work is by user requests. An agent is assigned to search for information based on the suitability of the user in the collection of work information that has been collected in the table. Furthermore, the system will provide information to the user automatically or job recommendations based on changes that occur in the online job portal.

6. Conclusion

The online job portal application allows job seekers and recruiters to be directly connected. The number of available job portals causes abundant information. This often causes job seekers to get confused and eventually take jobs that are not by their profile. Utilization of the multi-agent system in the job recommendation system created can gather all job information offered by all online job portals. The same work from several portals will be sorted and only displayed once. So the user will not be offered repeatedly. Based on the results of the implementation of the recommendation system using a multi-agent system can provide search results that are in accordance with what is inputted by the user based on the profile they have. These search results can recommend jobs that match the job seeker profile.

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