



## Applying Mobile Agent in Criminal Information Retrieval System

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**Abstract:** Mobile Agent is a type of software system which acts “intelligently” on one’s behalf with the feature of autonomy, learning ability and most importantly mobility. Therefore, Mobile Agent technology is suitable for collecting data from police stations on behalf of police officers. In this article, Mobile Agent will be addressed as tools for retrieving Criminal record of the offenders. The offenders’ biography is an important data for police officers in deciding criminal case. So, Mobile Agent technology is used for transferring this data between police stations. At first, the authorized police officer from any police station can search for the desired biography of an offender in its own database. If it is not found, the officer can search it at remote sites by using Query Agent (QA). To get that biography, Query Agent (QA) migrates from a host station to remote stations, negotiates with Database Agent (DA) in there, and replies the required information to Police Officer Agent (POA). By implementing this system, several advantages such as time saving, reduce paper work, flexible structuring, dynamic content delivery and less manpower requirement can be achieved. Moreover, it can upgrade the traditional information retrieval system to e-government system. This paper describes the project architecture and its implementation that is based on IBM’s Aglets Workbench.

**Keywords:** Agent-Based information retrieval system, Aglet framework, Data retrieval, Mobile Agent.

### I. INTRODUCTION

In today’s modernized era, the development of internet and rapidly improving computer technologies on a wider scale, Mobile Agent is also a useful and efficient tool for searching and retrieving data in distributed environment. Mobile Agents are an emerging technology that makes it very much easier to design, implement, and maintain distributed systems. A mobile agent is not bound to the system in which it begins execution. It has the unique ability to transport itself from one system in a network to another. This ability to travel allows a mobile agent to move to a system that contains an object with which the agent wants to interact, and then to take advantage of being in the same host or network as that object. Therefore, Mobile Agents have the potential of becoming a general frame work in which the different kinds of distributed information search and retrieval applications can be implemented efficiently and robustly [1]. Mobile Agents are an effective choice for many applications for several reasons, including improvements in latency and bandwidth of client-server applications and reducing vulnerability to network disconnection.

In this case, Mobile Agent technology is used for upgrading information retrieval system of police stations from manual system to computerized system. The operation of police station is a very essential role for a country. Operation of a police department affects the safety of residents, businesses, visitors and the officers the jurisdiction

employs. Moreover, the operation of a police station is definitely complicated. It has to involve creating special programs. And it does require planning, specific actions and time in searching an offender’s record. Biography of an offender is a very efficient data for police officers. Mobile Agent technology is used to assist the police officer in searching the desired biography effectively and rapidly.

The remainder is organized as follows. Section II gives a brief description of Mobile Agent technology. Section III explains basic needs for mobile agent and section IV describes about the architecture of the proposed system. Section V explains the experimental testing results. And Section VI concludes the paper.

### II. MOBILE AGENT TECHNOLOGY

Mobile agents are software entities that act more or less autonomously from their originator and have the ability to move from node to node in a distributed network maintaining some sort of state with the nodes of the network providing some amount of (possibly long term) storage and computational support. On each machine, the agent interacts with stationary agents and other resources to accomplish its task. Nowadays, mobile devices are put into use. Remote-sensing data about the earth’s environment is being created at an ever-increasing rate and distributed among the heterogeneous remote site. Traditional models of distributed computing are inadequate to support such complex application [2].

A mobile agent consists of the program code and the program execution state (the current values of variables, next instruction to be executed, etc.). Initially a mobile agent resides on a computer called the home machine. The agent is then dispatched to execute on a remote computer called mobile agent host (a mobile agent host is also called mobile agent platform or mobile agent server). When a mobile agent is dispatched the entire code of the mobile agent and the execution state of the mobile is transferred to the host. So, Mobile agents have several advantages in distributed information-retrieval applications [3].

**A. Aglet**

The Aglets Software Developer Kit (ASDK) was developed at IBM Research Laboratory in Japan. It is a framework for programming mobile network agents in Java. An aglet can be dispatched to any remote host that supports the Java Virtual Machine. This requires from the remote host to have preinstalled Tahiti, a tiny aglet server program implemented in Java and provided by the Aglet Framework. A running Tahiti server listens to the host's ports for incoming aglets, captures them, and provides them with an aglet context (i.e., an agent execution environment) in which they can run their code from the state that it was halted before they were dispatched. Within its context, an aglet can communicate with other aglets, collect local information and when convenient halt its execution and be dispatched to another host. An aglet can also be cloned or disposed [6].

**III. BASIC NEEDS FOR MOBILE AGENT**

The mobile agent in its promising paradigm provides a new means of communication amongst the network nodes. Both the computers and networks on which a mobile agent system is built are heterogeneous in character. As mobile agent systems are generally computer and network independent, they support transparent operation. Convenient development paradigm: The design and construction of distributed systems can be made easier by the use of mobile agents [4]. There are three basic needs for Mobile Agents to achieve these goals, the Mobile Agent Program, Mobile Agent Platforms and Mobile Agent Creator. Today the mobility is performed by different coding methods. So, the conventional programming Languages cannot be applied in implementation. However, implementation through java due its independent execution environment is somehow being managed to build distributed applications. The following operation: Creation, Cloning, Dispatching or Migration, Retraction, Activation, Deactivation and finally Disposal have been carried out through java. These operations constitute the mobile agent life cycle.

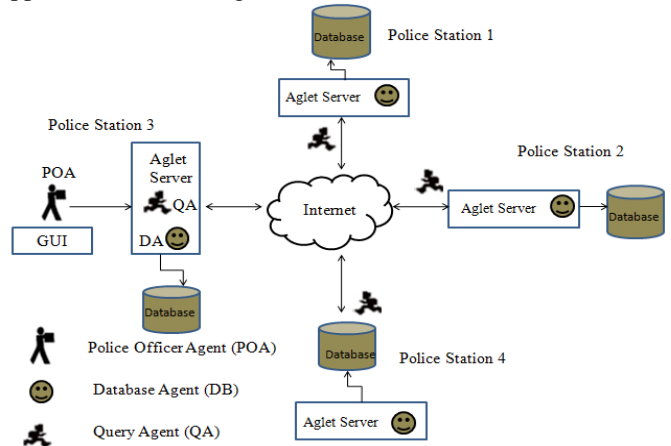
Creation is the first phase in the mobile agent life cycle. Whenever a request is made to the mobile agent, a mobile agent instance is created which means a desired parameter is equipped with the mobile agent to achieve its goal before any further work is done. Cloning refers to creating a copy of the original mobile agent object. This operation is used when the need for another agent with the same feature arises. The Migration or Dispatching is used for moving the agent from

one node to another by specifying address of the destination. The migration is of two types. One is strong Migration in which the mobile agent itself, its data and its state move. Second one is weak Migration which includes mobile agent itself and its data. The Retraction function is used whenever agent's source node required that its agent returned to the original host after completion of its job. To start and stop of mobile agent is done by the Activation and Deactivation operation. Finally Disposal operation is at the end of the mobile agent life cycle.

The second requirement is the mobile agent platform or execution environment. Mobile agent platform must be implemented and exists to run the mobile agent application. Mobile agent platform must have some special characteristics so that the host may know how to deal with the incoming agents and provides the environment to those agents so that they can achieve their goals. For this, the requirement should be platform independence, authentication, secure execution, dynamic class loading, network connectivity and resources control. These requirements should be provided by the mobile agent platform. Over the past few years, numbers of industrial mobile agent platform have been proposed which provides these resources such as Aglets, Voyager, Grasshopper, Tryllian, JADE, Tracy, SPRINGS [4]. The third requirement is the mobile agent creator means developers who developed the mobile agent system based on two main models. The first model which is just as an extension to the operation system function, controls the mobile agent life cycle and provides one platform per host. This model does not give much flexibility because each agent has operated based on their allocated platform and does not operate independently. The second model is compound based model which separates the platform from the host. This separation helps developers to a wide range of mobile agent applications because now agents operate autonomously [5].

**IV. THE PROPOSED SYSTEM ARCHITECTURE**

This session presents the system which aims to develop criminal information retrieval system using Mobile Agent. Mobile Agents are an effective paradigm for distributed application. Mobile Agents are autonomous software entities



**Figure1. Proposed System Design.**

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that can halt themselves, ship themselves to another agent enabled host on the network, and continue execution, deciding where to go and what to do along the way. Therefore, retrieval system can be built in a truly distributed fashion for all e commerce and e government. The overview of the system is shown in figure 1. There are five agents in the proposed system which is composed by using two kinds of agents: stationary and mobile. Stationary agents are Sign Up Agent (SA), Log In Agent (LA), Police Officer Agent (POA) and Database Agent (DA). There is one mobile agent named as Query Agent (QA). At first, Police Officer Agent (POA) can give the user's GUI window to start the user's tasks such as user registration process, user log in process and criminal record searching process. In the user registration process, SA is created by POA. LA is also created by POA in the user log in process. The main function of POA is needed to accept the offender's name and NRC number from police officer in criminal record searching process. And then, POA searches the desired data in its own database and at remote database. At remote site, POA negotiates with DA and carries back the result to the original station.

The associated tasks of the POA are illustrated in figure 2.

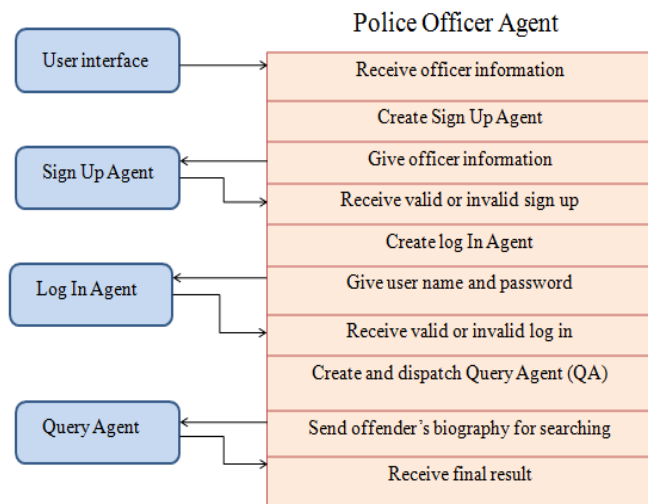


Figure2. Police Officer Agent and its Associated Tasks.

The associated tasks of the DA are illustrated in figure 3.

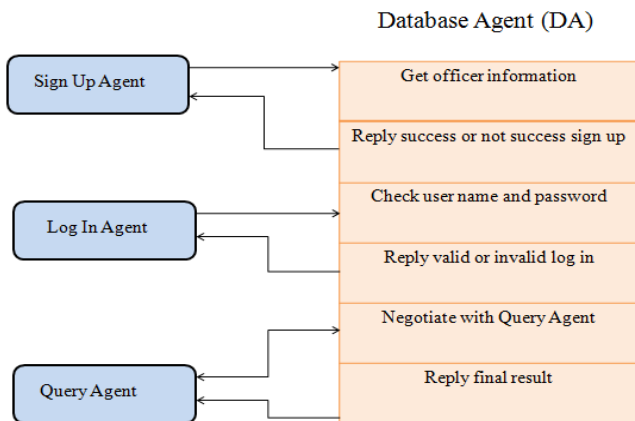


Figure3. Database Agent and its Associated Tasks.

The associated tasks of the QA are illustrated in figure 4.

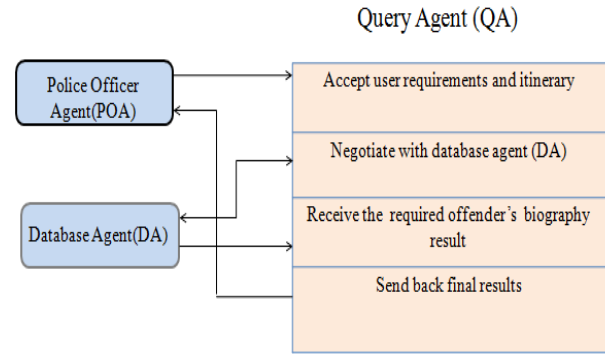


Figure4. Query Agent and its Associated Tasks

## V. EXPERIMENTAL RESULTS

The user interfaces of the proposed system are described in this section. The research work is carried out on machine in which Window 7 operating system, Aglets 2.02 version and J2SDK 1.5.1\_10 are installed on that operating system.

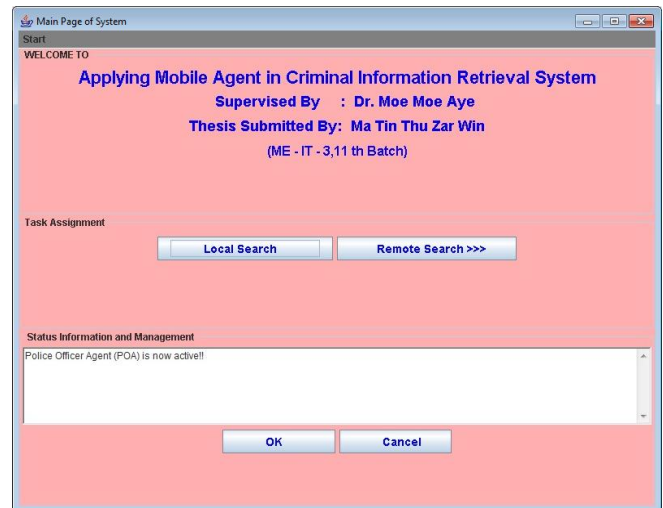


Figure5. Main window of Proposed System.

Figure 5 is the main window which displays all processing of information retrieval system. If the police officer wants to search the biography of an offender, it must be sure that he is an authorized person. Thus, the officer must perform the Sign up, Log in and Log out process through the start menu. If the log in is success, the authorized officer can search the desired data. In the main window, the officer can search the criminal record by clicking "Local Search" and "Remote Search" button. At first, if the new biography of an offender is needed to search in its own database, the "Local Search" button must be clicked. The data must be filled in criminal record searching form as shown in figure 6. If the desired data is not found in its database, QA is created by POA, and accepted input data from POA, and cloned and dispatched to the remote police stations through the network. At that time, the officer must be clicked the "Remote Search" button for searching at remote site. And then, the required data must be filled as shown in figure 7.

Figure6. Criminal Record Searching Form.

Figure7. Query Agent Frame.

After getting the required data and the address of the remote police stations, it is dispatched to the destinations. When QA arrives at the destination, it negotiates with DA at remote site as shown in figure 8.

Figure8. Database Agent Frame.

If the desired record is found at remote site, the result frame is as shown in figure 9. After getting the required record from the DA at remote site, QA carries back the result to the host and provides it to the POA.

Figure9. Criminal Record Result form.

## VI. CONCLUSION

Mobile Agent Based Information Retrieval System for Criminal Records is described in this paper. By implementing Mobile Agents in the proposed system, it can give us clear advantages such as reducing network load, the ability to interact with their execution environment, independence from network disconnections, act asynchronously and autonomously upon it and flexible structuring. Moreover, it can save time and reduce paper work for all officers at police station, perform faster and more accurately in deciding criminal record of an offender. This system aims to upgrade the traditional information retrieval system to e-government system. Therefore, in the future, the officers are better supported in criminal record searching by using Mobile Agent. Moreover, Java environment provides the platform independence; the future research should test and evaluate the performance of

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## VIII. REFERENCES

- [1] Yariv Aridor : "Agent Design Patterns:Elements of Agent Application Design". IBM Tokyo Research laboratory, Yamato, Kanagawa, Japan.
- [2] Brian Brewington et al."Mobile Agents in Distributed Information Retrieval".Thayer School of Engineering/ Department of Computer Science Dartmouth College, Hanover, New Hampshire 03755.

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- [3] Shahram Rahimi: "Comparision of Mobile Agent Frameworks for Distributed Geospatial Data Integration". Department of Computer Science and Statistics.
- [4] D.Lange, M. Oshima,1998,"Programming and Deploying Java Mobile Agents with Aglets".Addison Wesley, ISBN: 0201325829.
- [5] Yashpal Singh, Kapil Gulati and S Niranjana:"Dimension And Issues of Mobile Agent Technology".IJAIA, Vol 3, No 5,September 2012.
- [6] Onn Shehory: "Agent cloning: an approach to agent mobility and resource allocation". The Robotics Institute, Carnegie Mellon University.