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A Framework for Computer Aided Investigation of ATM Fraud in Nigeria

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Abstract: The conventional approach for criminal investigation and trial of cases in the law courts in developing countries like Nigeria is usually slow and unreliable. Consequently, the society is characterized by prolonged periods of detention of the suspects awaiting trial and congestion in the prisons and law courts. This paper attempts to describe the application of Artificial Intelligence (AI) in the investigation of ATM fraud in Nigeria. An Expert System (ES) is proposed which provides and supports the storage and intelligent interactive processing of the knowledge acquired by and experience of the human expert in the domain of criminal investigation, law and justice. One of the objectives of the study is to provide an intelligent computer-based system which will smooth, enhance and speed the efficient and reliable performance of the human expert in the domain of criminal investigation of ATM fraud in Nigeria. Other objective is to provide a system for computer aided learning of criminal investigation.

Key words: ATM fraud, framework, user, culprit, bank, bank staff, ATM clone, investigate, expert system

INTRODUCTION

It is hard to take the entire suite of banks' e-business services and decide on the most useful. Internet banking for instance, takes the word convenience several notches beyond the traditional Nigerian bank customer's wildest imaginations.

But then, it is so infrastructure dependent at the customer ends (PCs, internet service providers, electricity, etc.) as to be of limited utility in an economy such as ours. But the debit card is something else! Along with the now ubiquitous Automated Teller Machines (ATM), it is like walking around with your favourite bank branch in your breast pocket.

There is however, a new cost to running ATM machines in the country which although not peculiarly Nigerian, is increasingly taking on a distinct local flavour. This is the cost to the banks of ballooning ATM fraud. The immediate worry is reputational. And so most banks started by paying out for fraud perpetrated through their customers' debit cards.

The fraud just kept on growing. So the initiative shifted: caps were placed on the maximum amount one can withdraw in a single transaction and the number of permissible transactions in a given day; limits are being enforced on the size of purchases via point-of-sales terminals and a media advert blitz has helped transfer responsibility to the customer for securing the integrity of each card.

If the banks are to be believed, the duty of care arising from my access to and use of a debit card is akin to that traditionally associated with my use of a cheque. Banks being thereby absolved of all responsibility to make good any loss arising from the negligent handling of a chequebook, in such a way that it falls to the use of a third party intent on illegally withdrawing from the customer's account.

And so we have taken to looking over our backs to ensure that the person behind one on the ATM queue is not unduly interested in acquiring one's personal identification number. It is obvious too that because the larger count of numbers which make up each card's serial

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number are identical across platforms, it is very easy for the determined felon to commit to memory the unique portions of each card's serial number from the most casual encounter.

But none of these is sufficient protection to the customer against malware installed on the ATMs. It turns out that a number of ATMs in operation in the country still run on their default passwords. In the hands of the wrong persons, these passwords allow the reconfiguration of the ATMs and the installation of malicious softwares that sends personal data about users to unauthorised parties. Customers do well to guard against the malware dimension to their ATM usage by avoiding off-site locations, it's apparently a lot more difficult to go install malware in machines located in bank branches. But who is responsible for ensuring the integrity of the many electronic payment solutions currently being deployed by the financial services industry?

About 6 years ago, the Central Bank of Nigeria, CBN issued a consultation paper titled Guidelines on Electronic Banking in Nigeria in which it insisted that in view of the demonstrated weaknesses in the magnetic stripe technology, banks should adopt the chip (smart card) technology as the standard, within 5 years. For banks that have not deployed ATMs, the expectation is that chip based ATMs would be deployed.

The general design of the existing four generations of computers is based on the Von Neumann machine processor, a memory, arithmetic and logic unit and input output devices. The computers operate in a largely serial fashion, step by step and widely applied in routine data processing, mathematical and statistical calculations in science and engineering. The limitations of these computers have been discussed in Cookson *et al*. (1985).

Only a small segment of the activities of the professional in business, science and engineering has as its kernel mathematical algorithms. The majority of the thinking professionals do is done by reasoning rather than calculating (Braman, 1986).

Artificial Intelligence (AI) is a subfield of computer science concerned with the concepts and methods of symbolic inference by a computer and the symbolic representation of the knowledge to be used in making inferences typical of human reasoning. The earliest work in AI focused on the construction of general-purpose intelligent systems.

Figure 1 General-purpose deductive schemes do not emulate human experts and therefore lack the efficiency and flexibility necessary for solving complex practical problems (Roycraft and Loucopoulos, 1985). The recent developments emphasis Expert System (ES) which

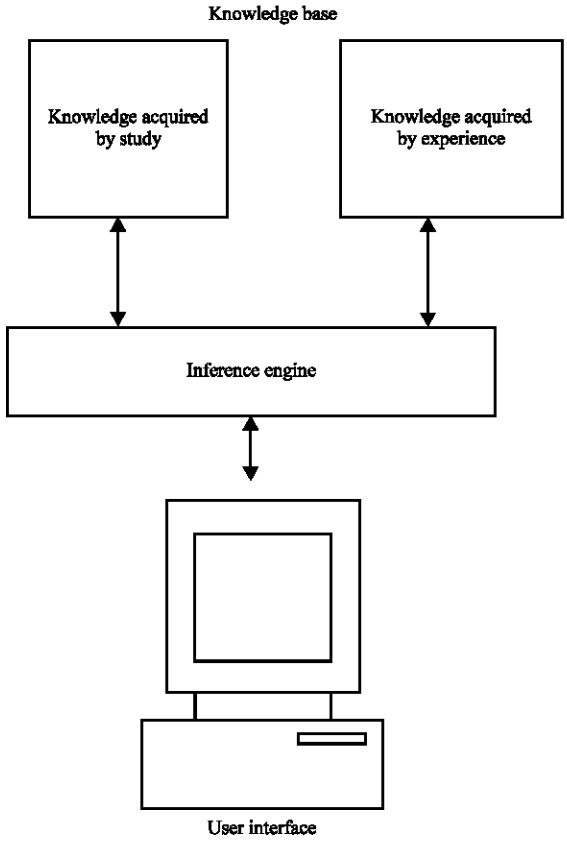

Fig. 1: Architecture of the intelligent system

is concerned with the role and use of the knowledge of a specific problem domain. A number of ESs in the domains of medical diagnostics, diagnoses of faults in electronic components and image processing have been proposed by Roycraft and Loucopoulos (1985) and Shortliffe (1976). The formalization of law and the development of computer systems to assist with criminal investigation and administration of justice provide a rich domain and testing A I technology (Bramer, 1984).

The cost and benefits of the direct, single goal and conceptual approaches for the representation of the British statutory law using logic are discussed. A prototype ES which can be used in one area of the British tax legislation known as the apportionment of close companies income is presented by Sanda (1986).

Every nation has a department within its Police Force which is charged with the responsibility of criminal investigation. The department relies primarily on the information collected from complainants, witnesses and existing records of criminal cases in an attempt to investigate a case on hand.

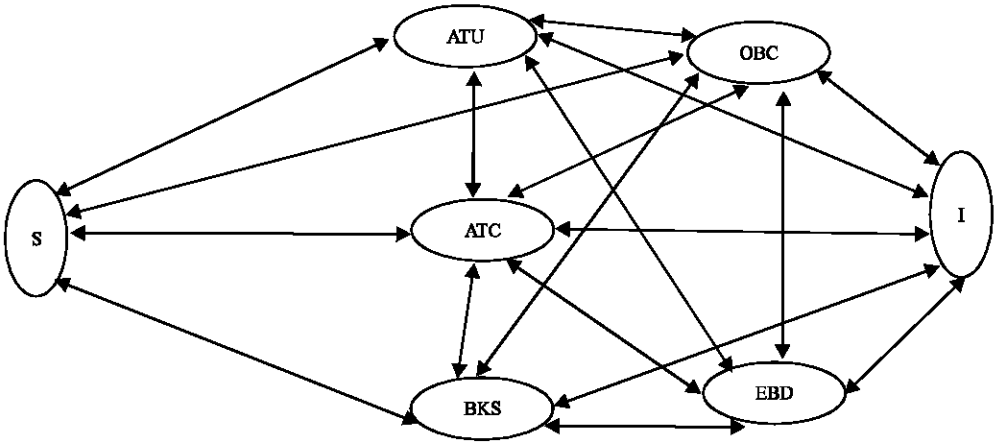

Fig. 2: Semantic network of ATM fraud ATM User (ATU); BANK Staff (BKS); Card Cloner (ATC); Other Bank Customer:obc; Everybody: EBD

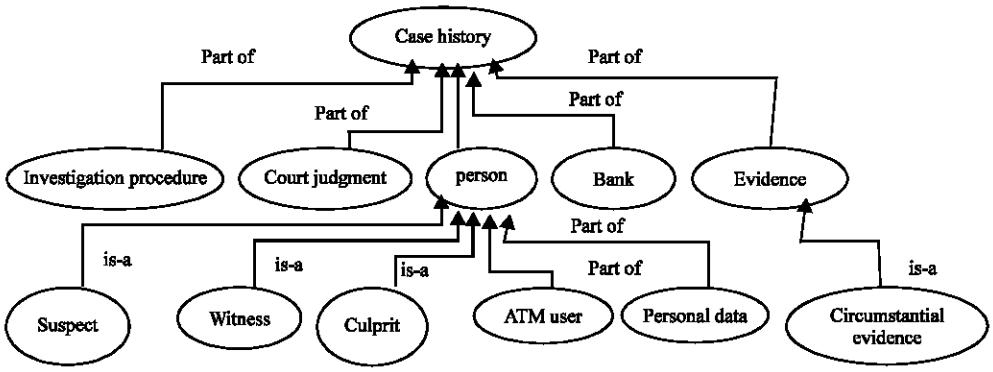

Fig. 3: Conceptual graph of case study

The existing records have to be searched in order to find out wether a crime just committed and under investigation can be related to some cases in the past. The existing records are often kept piecemeal in file cabinets in developing countries. The manual file system lacks standard procedures for data formatting, storage, retrieval, maintenance and documentation. Furthermore, there is no central control, thus data security and privacy cannot be guaranteed. The processing of the manual file is usually slow and a tedious task, particularly when the population of records to be searched is large. The time lag between the time a crime is committed and that by which the investigation is completed is usually too long. The process of prosecution is often jeopardized. There is a chance of justice being switched unduly in the long process, after all, justice delayed is justice denied.

A case history is described by the victim of ATM fraud, witness, culprit, personal data of complainants, investigation procedure and judgement. The conceptual model of the case history is formulated using the concepts of data abstraction, namely: classification, generalization, aggregation and association (Fig. 2).

The graphical representation of the conceptual model is shown in Fig. 3. A node in the graph describes an entity type and an arc describes the semantic relationships between two entity types. The attributes of the entity types and information derivable using experience have been suppressed in the conceptual graph for clarity.

THE INFERENCE ENGINE

Knowledge serves as the basis for reasoning by a knowledge information processing systems but it is not sufficient in itself to discover and use lines of reasoning (Shortliffe, 1976). The inference engine is concerned with piecing together an appropriate line of reasoning which leads to the solution of a problem or the formulation of a body of consultative advise. In this research, the

inference engine coded in modules using the IF THEN clause in JAVA programming language is proposed. The modules are hierarchically structured and the details of the information contents increased downward.

Thus a module in the hierarchy can call another module at lower level thereby supporting the forward chaining strategy of inference engine. The upward chaining of modules in the hierarchy is allowable and this supports the backward chaining strategy of inference engine.

The textual descriptions of some of the modules in the content of ATM fraud in Nigeria are given in the following:

- IF the ATM user properly handles the ATM Card and he finally discovered that a fraud occurred on his account THEN any staff of the bank is a suspect
- IF the ATM user carelessly handles the ATM Card while using the ATM Card in the banking hall THEN bank staff and other customer of the bank are suspect
- IF the ATM user loses his ATM Card THEN anybody is a suspect
- IF the ATM user carelessly drops his receipt generated through theATM Machine THEN customer on the queue is a suspect

A deduction based on the investigation of the semantic network may be valid but the truth value may be false. A deduction in this context will be true only when the history of the existing cases has been processed and findings favour the deduction.

Consider for example, the module given above. The deduction that the bank staff and a customer of the bank are suspects in an ATM fraud in the past in a case under investigation may be valid. The information deduced from the existing records may show that suspects in this category have been executed by firing squad some years ago. Therefore, the truth value of the earlier assertion is false, then another course of action has to be taken and this may lead to some chains of investigation procedures.

Thus there are many alternative paths which can be navigated in the semantic network thereby leading to many alternative decisions. A weighing function based on the principle of probability distribution of the decision extracts from the case history is built into the inference engine. A navigational path which is favoured by a decision extract with the highest weight is considered valid and true.

THE USER INTERFACE

The user interface acts primarily as the communication medium between the user and the ES. It provides the resources for the user to ask questions and offer information, in principle at any time and without binding the user to respond narrowly to the system's initiatives (Craig, 1986).

In this research, a user interface which is based on pseudo-natural language coupled with menu driven facility is proposed. A user view of the system is hierarchically structured. He gains access to the system by supplying valid user name and password. Following this, the system prompts the user for category of fraud which is of interest. It is remarked that the system will incorporate other types of crime apart from the ATM fraud such as murder, rape, highway robbery and warehouse robbery. The system presents to the user the scenario of the modules which compose the inference engine concerning the crime requested. The user then calls the module one at a time. The system guides the user but always leaving the ultimate decisions to the user.

CONCLUSION

This study has addressed the design of an intelligent computer based system for investigation of ATM fraud in Nigeria. The architecture of the system has been presented and its functionality described. It has been shown that there are many alternative paths that can be taken in the investigation of ATM fraud in Nigeria. The alternative paths have been modeled using the concept of semantic network.

Given the events, activities and objects associated with a reported criminal offence and their inter-relationships, the framework proposed provides the mechanism for the intelligent interactive processing of the corresponding semantic network of the crime and the history of existing cases.

The interactive processing considers a number of key factors which can be related, weighted and alternative deductive reasoning evaluated with the intention of identifying the set of culprits involved in a given case.

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