Expert System for Islamic Punishment (ESIP)

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Abstract:
It is undesirable to treat a criminal lightly who threatens the security of society with danger. This paper presents the design and development of an expert system for Islamic punishment (ESIP). The knowledge base in the ES is intended to obtain based on the Al-Quran and the Prophetic sayings (Hadith). The Islamic penal system has many objectives. The First objective: Islam seeks to protect society from the dangers of crime. The Second objective: Islam seeks to reform the criminal. The Third objective: the punishment is a recompense for the crime. We implement our expert system using powerful and famous expert system shell called EXSYS CORVID Java-Based Expert System Knowledge Automation. We apply the expert system to be worked on the Web directly. Our expert system outperform the efficiency of the Islamic punishment manual system.

1. Introduction

The punishments in Islamic penal system are not prescribed as ends in themselves, as propagated by the 'Western individualistic philosophy' advanced by Kant and Hegel. The punishments are, in fact, a means of promoting moral values and general welfare of human society. The philosophy of Islamic punishments is remarkably different from and highly superior to the penal philosophy advanced by Western criminologists [1].

Punishments have always been considered an integral part of the concept of justice. Indeed, a common man would find it hard to think of justice as something very different or separate from rewarding or punishing people according to how well or badly they observe the body of the mutual rights and obligations in their society. But if the concept of punishment is universal, the controversies surrounding it are nonetheless intense. We shall now look at some basic Islamic principles concerning punishments.

Discretionary Punishments these are punishments that are not fixed by Islamic Law, for crimes that either infringe on the rights of God or the rights of an individual, but do not have a fixed punishment or a set expiation.

Discretionary punishments are the broadest category of punishments, because the crimes that have fixed punishments are few in number and all other crimes fall under the scope of this.

They are the most flexible type of punishment, because they take into consideration the needs of society and changing social conditions. Consequently, they are flexible enough to realize the maximum general benefit to society, effectively reform the criminal, and reduce the harm that he causes.

Islamic Law has defined different types of discretionary punishments starting from exhortations and reprimands to flogging, to fines, and to imprisonment. These discretionary measures are left to the decision of the legal authorities within the general framework of Islamic Law and the universal purposes of Islam that balance between the right of society to be protected from crime and the right of the individual to have his freedoms protected.

Expert System (ES), also called a Knowledge Based System (KBS), is computer application programs that take the knowledge of one or more human experts in a field and computerize it so that it is readily available for use.

Expert system is the chief research achievements of artificial intelligence area, it can simulate the inference process of human expert by computer technology, and reach the ability or level of similar human expert[2-3].

The outline of the paper is as follows. Section 2 problem recognition. Section3 presents the basic principles. Section 4 components of an expert system. Section 5 knowledge representation and complete example. Section 6 tool used in knowledge representation finally, section 7 summarizes this paper.

2. Problem Recognition

We have three motives to build our expert system, which can be stated as follow; to distribute human expertise in this science, to prevent injustice in punishment by applying Islamic laws in this science,

and to preserve punishments laws in Islam from forget and loss.

3. Basic Principles

Each human being is responsible for his or her actions. This simple truth provides the whole basis for the justification of punishment; for to fulfill the purpose of this creation, mankind has been granted the freedom to choose and act and the moral sense to distinguish between right and wrong. Responsibility goes with knowledge and freedom. Punishment cannot, therefore, be meted out to one person for another person action, for acts intended but not performed, or for acts done under duress or while not of sound mind. Everyone must be equal before the law and their guilt must be established by the due process of justice.

3.1. Repentance and Punishment

Punishment in Islam has nothing to do with the notions of atonement, expiation or wiping away of sin. A crime is essentially an act of injustice to one's own self, a sin against God. It can be wiped away only by God, and that He does when a person turns to Him, truly repentant and seeking forgiveness. Between man and God, therefore, the total emphasis is on repentance, and punishment can be no substitute for it. But a crime is also an act against the social order and in this sphere mere repentance cannot be a substitute for punishment which is a means of protecting and strengthening the society.

3.2. Functional Nature

Penalties in Islam are more of a functional nature, to regulate and deter. God has laid down a body of mutual rights and obligations which are the true embodiment of justice. He has also laid down certain bounds and limits to be observed and maintained for this very purpose. If men and nations desire to move in peace and safety on the highways of life, they must stick to the 'traffic lanes' demarcated for them and observe all the 'signposts' erected along their routes. If they do not, they not only put themselves in danger, but endanger others. They therefore naturally make themselves liable to penalties –not in vengeful retribution – but to regulate the orderly exchanges in man's life in accordance with justice.

3.3. Retribution

This is the second type of punishment in Islamic Law. This is where the perpetrator of the crime is punished with the same injury that he caused to the victim. If the criminal killed the victim, then he is killed. If he cut off or injured a limb of the victim, then his own limb will be cut off or injured if it is possible without killing the criminal. Specialists are used to make this determination.

3.3.1. Important Rules Regarding Retribution

1. Retribution is not lawful except where the killing or injury was done deliberately. There is no retribution for accidentally killing or injuring someone.
2. In the crimes where the criminal directly transgresses against another, Islam has given the wish of the victim or his family an important role in deciding whether or not the punishment should be carried out. Islam permits the victim to pardon the perpetrator, because the punishment in these crimes is considered the right of the victim. Islam even encourages pardon, promising a reward in the hereafter for the one who does.
The pardon can either be to the payment of blood money, a fixed, monetary compensation, or can be total, where no worldly compensation is demanded.
3. The punishment must be carried out by the government. The family of the victim cannot carry it out.

3.3.2. The Wisdom behind Retribution

With regard to Islamic punishments in general, and retribution in specific, we find that they have two complementary characteristics. The first of these is the severity of the punishment. This is in order to discourage the crime and limit its occurrence.

The second characteristic is the difficulty of establishing guilt, reducing the opportunities for carrying out the punishment, and protecting the accused. In this vein, we see the principle that punishments are waived in the presence of doubt, and that the benefit of the doubt is always given to the accused. Some prescribed punishments are even waived on the grounds of repentance, as we can see in the case of highway robbery. This is also seen in the permissibility of pardon in the case of retribution and the fact that pardon is encouraged and preferred.

These two elements complement each other in that crime is effectively discouraged, protecting society, and the rights of the accused are safeguarded by the fact that speculation and accusations cannot be grounds for punishment, and that the accused enjoys the greatest guarantee of justice and being spared the punishment whenever possible. Most people will abstain from committing crime, because of the severity of the punishment, and the punishments for these crimes will rarely be carried out. In this way, the general security of society and the rights of the individual are equally realized.

4. Components of an Expert System

All expert systems are composed of several basic components: a user interface, a database, a knowledge base, and an inference mechanism. Moreover, expert system development usually proceeds through several phases including problem selection, knowledge acquisition, knowledge representation, programming, testing and evaluation.

Expert systems have a number of major system components and interface with individuals in various roles. These are illustrated in figure (1). The major components are [4]:
- **Knowledge base** - a declarative representation of the expertise, often in IF THEN rules;
- **Working storage** - the data which is specific to a problem being solved;
- **Inference engine** - the code at the core of the system which derives recommendations from the knowledge base and problem-specific data in working storage;
- **User interface** - the code that controls the dialog between the user and the system.

Figure 1 the Expert System Component

4.1. Importance of Knowledge

Knowledge can be defined as the body of facts and principles accumulated by human kind or the act, fact, or state of knowing. The meaning of knowledge is closely related to the meaning of intelligence. Intelligence requires the possession of and access to knowledge. And a characteristic of intelligence people is that they possess much knowledge.

Thus, we can say that knowledge includes and requires the use of data and information. But it is more. It combines relationships, correlations, dependencies, and the notion of gestalt with data and information.

5. Knowledge Representation

The knowledge the expert uses to solve a problem must be represented in a fashion that can be used to code into the computer and then be available for decision making by the expert system. There are various formal methods for representing knowledge and usually the characteristics of a particular problem will determine the appropriate representation techniques employed.

KBS are computer programs which capture and retain expertise that has been gained over many years of engineering experience and also employ knowledge gained from other (than human) knowledge sources. KBS can reason intelligently about necessary action to take in real time, thus freeing operational staff [5].

Moreover, separation of the knowledge base from the control elements allows the inference engine and algorithms to be generic so they can be applied to a variety of processes. This means that it is possible to begin operating a process with an empty knowledge base and create a new knowledge base for the particular process [6].

Also, knowledge representation has been defined as "A set of syntactic and semantic conventions that make it possible to describe things. The syntax of a representation specifies a set of rules for combining symbols to form expressions in the representation language. The semantics of a representation specify how expressions so constructed should be interpreted i.e. how meaning can be derived from a form" [7].

During the last thirty five years several different representation schemes appeared. These schemes have been classified into four categories [8]

Knowledge representation and reasoning is an area in artificial intelligence that is concerned with how to formally "think", that is, how to use a symbol system to represent "a domain of discourse" - that which can be talked about, along with functions that may or may not be within the domain of discourse that allow inference (formalized reasoning) about the objects within the domain of discourse to occur. Generally speaking, some kind of logic is used both to supply a formal semantics of how reasoning functions apply to symbols in the domain of discourse, as well as to supply (depending on the particulars of the logic), operators such as quantifiers, modal operators, etc. that, along with an interpretation theory, give meaning to the sentences in the logic.

When we design a knowledge representation (and a knowledge representation system to interpret sentences in the logic in order to derive inferences from them) we have to make trades across a number of design spaces, described in the following sections.
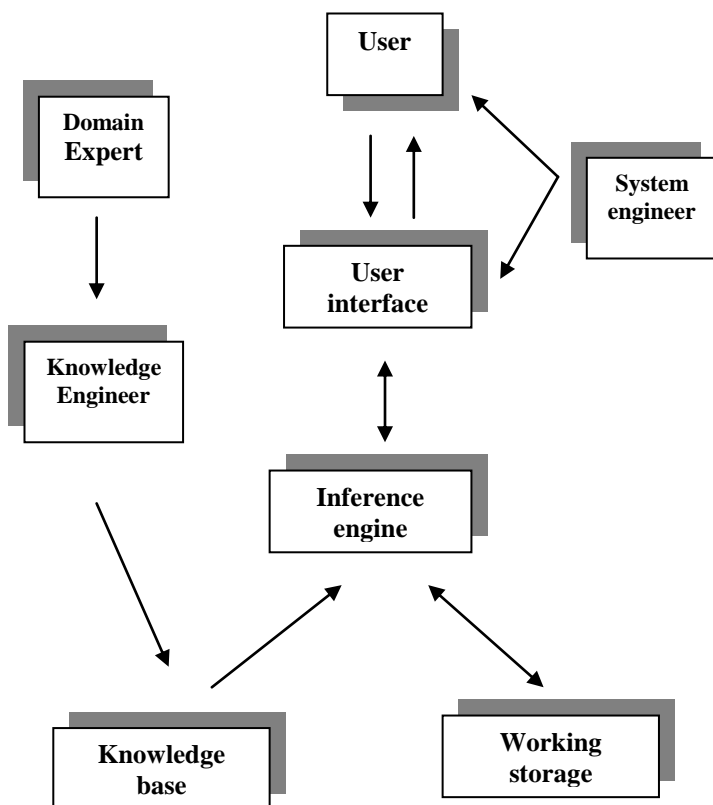
The single most important decision to be made, however is the expressivity of the KR. The more expressive, the easier (and more compact) it is to "say something". However, more expressive languages are harder to automatically derive inferences from. An example of a less expressive KR would be propositional logic. An example of a more expressive KR would be auto epistemic temporal modal logic. Less expressive KRs may be both complete and consistent (formally less expressive than set theory). More expressive KRs may be neither complete nor consistent.

The key problem is to find a KR (and a supporting reasoning system) that can make the inferences your application needs in time, that is, within the resource constraints appropriate to the problem at hand. This tension between the kinds of inferences an application "needs" and what counts as "in time" along with the cost to generate the representation itself makes knowledge representation engineering interesting.

There are representation techniques such as frames, rules, tagging, and semantic networks which have originated from theories of human information processing. Since knowledge is used to achieve intelligent behavior, the fundamental goal of knowledge representation is to represent knowledge in a manner as to facilitate inference (i.e. drawing conclusions) from knowledge.

Knowledge bases can be represented by production rules. These rules consist of a condition or premise followed by an action or conclusion **(IF condition...THEN action).**

For example

RULE 1 IF choose type of crime is mugging (1)
 AND the thief is adult (2)
 AND the thief was not Disguised when he mug (3)

THEN No ad judgment applied
 RULE 2 IF age > 15

THEN the person is adul**t**
RULE 3 IF age<15
THEN the person is not adult.
QUESTION age
QUESTION type of crime
QUESTION disguised.

To prove the conclusion "No ad judgment applied" inference engine must prove all condition that leading to this conclusion. Condition (1) and (3) can be found from asking user but condition (2) can be found by proving RULE 2 because this condition is conclusion in RULE 2.

## 6. Tool Used in Knowledge Representation

The term expert system tools loosely describe the software that is used for construction an expert system [9]. The general categories of expert system tools:

- **Decision Tree.**
- **Decision Table.**
- **EXSYS CORVID**

6.1. Decision Tree

A decision tree (or tree diagram) is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility Figure (2). Decision trees are commonly used in operations research, specifically in decision analysis, to help identify a strategy most likely to reach a goal. Another use of decision trees is as a descriptive means for calculating conditional probabilities.
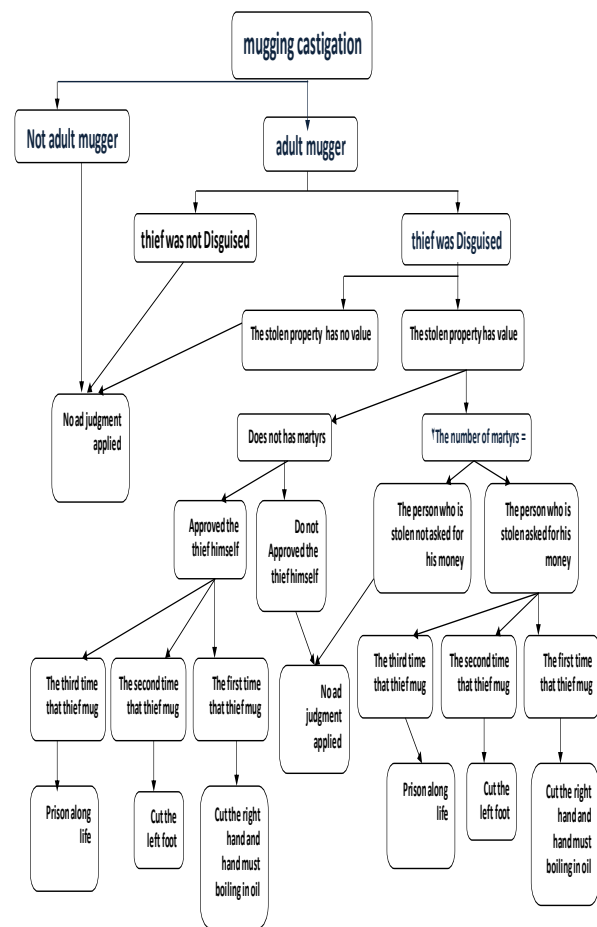
Figure 2 the Decision Tree

6.2. Decision Tables

Are precise yet compact ways to model complicated logic? Decision tables, like if-then-else and switch-case statements, associate conditions with actions to perform. But, unlike the control structures found in traditional programming languages, decision tables can associate many independent conditions with several actions in an elegant way.

Condition	1	2	3	4	5	6	7	8	9	10	11
choose type of crime?	M	M	M	M	M	M	M	M	M	M	M
is the thief adult?	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
was the thief Disguised when he mug?	-	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
is stolen property invaluable?	-	-	N	Y	Y	Y	Y	Y	Y	Y	Y
is there 2 martyrs on mugging?	-	-	-	N	N	N	N	Y	Y	Y	Y
is the thief approved him self ?	-	-	-	Y	Y	Y	N	-	-	-	-
how many time of his mugging	-	-	-	3TH	2TH	1TH	-	-	3TH	2TH	1TH
is The person who is stolen asked for his money?	-	-	-	-	-	-	-	N	Y	Y	Y
ACTION	A1	A1	A1	A2	A3	A4	A1	A1	A2	A3	A4

Condition	12	13	14	15	16	17	18	19	20	21	22	23
choose type of crime?	AD	AD	AD	AD	AD	B	B	B	WC	WC	WC	WC
is adultly with maharriem?	N	N	N	Y	Y	-	-	-	-	-	-	-
is Adulterer married?	N	Y	Y	-	-	-	-	-	-	-	-	-
is Adulterer old or guy?	-	G	O	-	-	-	-	-	-	-	-	-
is Adultery with wife of father?	-	-	-	N	N	-	-	-	-	-	-	-
is person compelled?	-	-	-	-	-	Y	N	N	-	-	-	-
is person slave or free?	-	-	-	-	-	-	slave	free	-	-	-	-
is way cutter kill any person?	-	-	-	-	-	-	-	-	N	N	Y	N
is way cutter mug pelf?									N	Y	N	N
ACTION	A5	A6	A7	A8	A9	A1	A10	A11	A12	A13	A14	A15

Condition	24	25	26	27	28	29	30	31	32	33	34
choose type of crime?	AI	AI	EA	EA	EA	K	K	K	K	K	K
is person repent?	N	Y	-	-	-	-	-	-	-	-	-
is Projectile pardoned him of adultery on the ejector?	-	-	N	N	Y	-	-	-	-	-	-
is person slave or free?	-	-	slave	free	-	-	-	-	-	-	-
what is type of kill?	-	-	-	-	-	E	QD	D	D	D	D
are Kinsfolk pardoned the killer?	-	-	-	-	-	-	-	N	N	N	Y
is the thief adult?	-	-	-	-	-	-	N	Y	Y	-	
is killer father or grand father of the slain?	-	-	-	-	-	-	-	N	Y	-	
ACTION	A16	A1	A10	A11	A1	A17	A18	A19	A20	A1	A21

Tables 1: Decision Tables

Where :

M=mugging , Y= yes , N=no , 1TH=first time, 2TH=second time , 3TH=third time .AD=adultery , B= booze drink ,WC= way cutter ,AI= apostasy from Islam, EA= ejaculation adultery , K=killing ,E = error kill, QD= quasi deliberateness kill, D= deliberateness kill. Action: A1 = no ad judgment applied, A2= Prison along life, A3=Cut the left foot,A4=Cut the right hand and hand must boiling in oil, A5=bumping100 time and send to unfamiliar area , A6=Bumping with stone until kill. A7=Bumping then Pelting, A8=Kill with sword in neck, A9=Pelting with stone until kill, A10= Bumping 40 time. A11=Bumping 80 time, A12=Sent to other countries, A13=Cut right hand and left foot, A14=kill, A15=Kill and crucify, A16=must kill, A17= Payment of a sum of money and freeing a slave and if did not find , fast two months consecutive. A18= Payment of a sum of money, 4250 grams of gold and freeing a slave and if did not find , fast two months consecutive. A19= Payment of a sum of money, 4250 grams of gold. A20= Kill the killer person. A21= Payment of a sum of money, 4250 grams of gold and freeing a slave and if did not find , fast two months consecutive.

6.3. EXSYS CORVID

Exsys Corvid Knowledge Automation expert systems interact with users to offer answers whenever needed. Far better than search or FAQs, they provide precise, reasoned situation-specific advice based on the knowledge of top experts.

Working Example

We can represent this rule using our representation as follow:

```
menu_mugging(press) :-
  not(yes_no("question " ," is theif adult ? " ,?)),
  message("result " ,"no adjudgmnt applied !" , n).
menu_mugging(press):-
not(yes_no("question" ," was theif disguised when he mug ", ? )),!,
message("result " ,"no adjudgmnt applied !" , n).
menu_mugging(press):-
not(yes_no("question","is stolen property invaluable ? " , ?)),!,
message("result " ,"no adjudgmnt applied !" , n).
menu_mugging(press):-
not(yes_no("question","is there 2 martyrs on mugging ? " , ?)),
(yes_no("question","is theif approved him self" , ?)->
read(X,"how many time of this mugging ? "),!,
(X=3-> message("result " ,"Prison along life " , n)),
(X=2-> message("result" ," cut left foot " ,n)),
(X=1-> message("result","cut right hand and boiling it in oil " ,n )),
((X<1;X>3) -> message("error" ,"choose 1 or 2 or 3 " , !))
else
message("result","no adjudgment applied" , n)).
```

Figures 3, 4, 5 and 6 present some samples from the proposed expert system forms and menus.
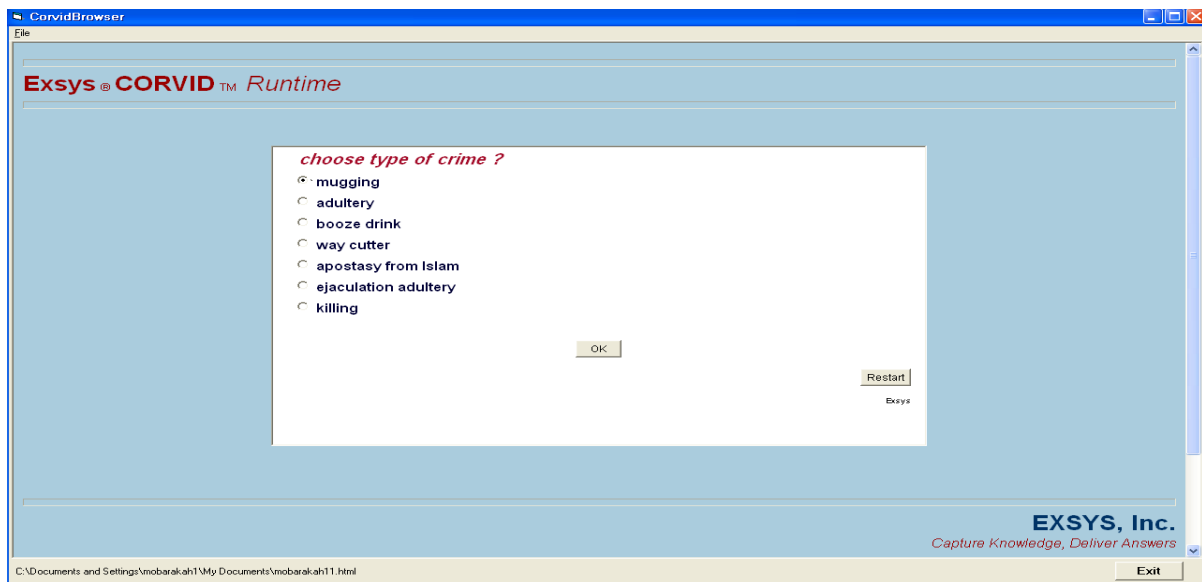
After Execution

Figure 3 Chose type of crime

Figure 4 is the thief adult

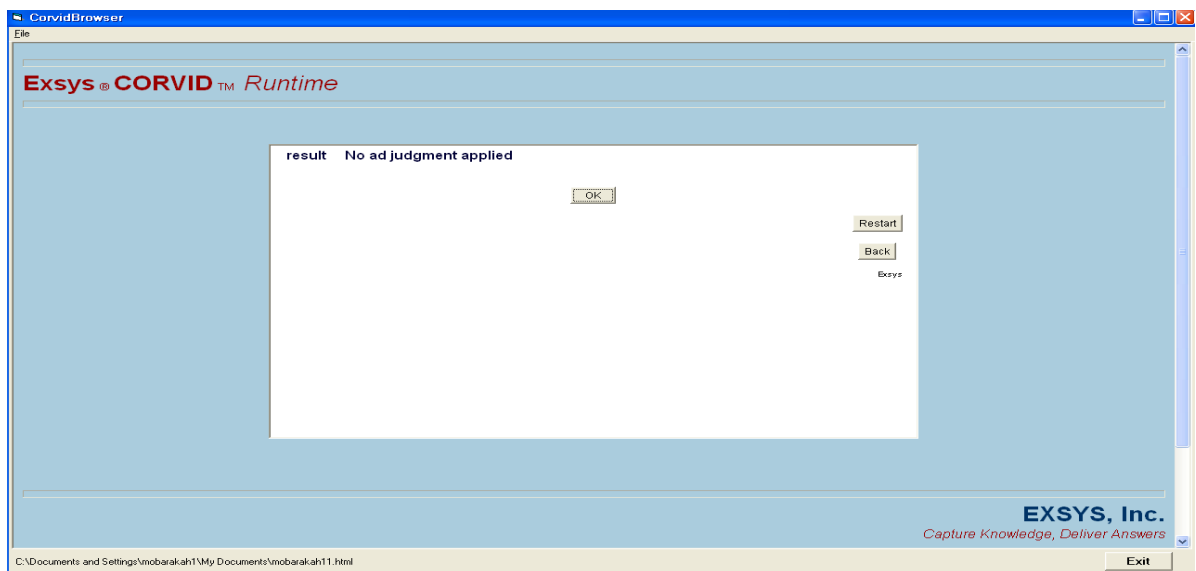**Figure 5 was the thief Disguised when he mug**

Figure 6 result

7. Conclusions

We demonstrated a computer based expert system for Islamic punishment. This expert system is implemented using EXSYS CORVID shell. Our system is easy to use, powerful, and have friendly graphical user interface. Our expert system can punish guilty of crime, thereby acting as a Kaffara (purification) and reforming them, act as a deterrent for society from committing crime, and retribution for those who are victims of crime. Our expert system is considered as a kick-start to create awareness for Muslims to have a better understanding on the application of the Quranic verses for punishment

8. Future work

We will enhance our proposed expert system with some sort of explanation (How and Why).

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