

Software Engineering Ethical Principles Based on Islamic Values

Shihab A. Hameed

International Islamic University Malaysia, Electrical and Computer Engineering, KL, Malaysia

Email: shihab@iiu.edu.my

Abstract—Software is the core for computer-based applications became an essential part for critical control systems, health and human life guard systems, financial and banking systems, scientific and educational, entertainments and other systems. Software is the core for such applications. It requires qualified software engineers: professionally and ethically. Literature review (L.R) and survey results show that software engineering professionals are facing several ethical-related problems which are costly, harmful and affected high ratio of people. Professional organizations like ACM, IEEE, ABET and CSAC have established codes of ethics to help software engineering professionals to understand and manage their ethical responsibilities. Islam considers ethics an essential factor to build individuals, communities and society. Islamic ethics are set of moral principles and guidance that recognizes what is right behavior from wrong, which are comprehensive, stable, fair, and historically prove success in building ethically great society. The estimated 1.5 billion of Muslims with tens of thousands of software engineers should have an effective role in software development and life, which requires them to understand and implement ethics, specially the Islamic ethics in their work. This paper is a frame-work or roadmap for modeling software engineering principle, which shows the main phases for solving such problem. It focuses mainly on adopting a new version of software engineering principle based on Islamic ethical values.

Index Terms—Ethics, software engineering ethics, Islamic ethics, computer crime, ethical problem

I. INTRODUCTION

In this computer, communication and information era, computer-based applications became an essential part of human life. It is the core for critical control systems, health and human life guard systems, financial and banking systems, scientific and educational systems, entertainment and games, and other systems related to different aspects of human life. The world market for such applications is worth hundreds of billions USD and it affects almost all people's life directly or indirectly, farther more it includes a reasonable ratio of workforce. Software is the core for such computer-based systems. Software development requires qualified professional and ethical software engineers. Computer ethics is one of the essential branches of ethics that is growing and changing rapidly as computer technology grows and develops. In Stanford encyclopedia of philosophy [1], computer ethics

might be understood narrowly as the efforts of professional philosophers to apply traditional ethical theories or virtue ethics to issues regarding the use of computer technology; or might be understood broadly to include standards of professional practice, codes of conduct, aspects of computer law, public policy, corporate ethics beside certain topics in the sociology and psychology of computing. Since information technology has begun to affect community life, family life, human relationships, education, freedom, etc; so the computer ethics can be understood as the branch of applied ethics which studies and analyzes such social and ethical impacts of information technology.

Walter Maner [2] in mid 1970s defined the computer ethics as one which examines "ethical problems aggravated, transformed or created by computer technology". Deborah Johnson [3] thought that computers gave a "new twist" to old ethical issues which were already well known. Moor's [4] defined computer ethics as a field concerned with "policy vacuums" and "conceptual muddles" regarding the social and ethical use of information technology. Moor's way is very powerful, suggestive, broad enough to be compatible with a wide range of philosophical theories and methodologies, and it is rooted in a perceptive understanding of how technological revolutions proceed. This very broad view of computer ethics employs concepts, theories and methodologies from applied ethics, sociology of computing, technology assessment, computer law, and other relevant disciplines [5]. This way of understanding computer ethics is reflected in recent developments such as Brey's "disclosive computer ethics" methodology [6] and the emerging research field of "value-sensitive computer design" [7, 8, 9].

In Gotterbarn's view, computer ethics should be viewed as a branch of professional ethics, which is concerned primarily with standards of practice and codes of conduct of computing professionals [10]. Gotterbarn has been involved in a number of activities, such as co-authoring the third version of the ACM Code of Ethics and Professional Conduct and working to establish licensing standards for software engineers [11, 12] based on this view. Codes of ethics suffer from limitations in real world; It lay out general ideals of ethical behavior, and often establish specific rules for commonly encountered situations so, no list of ideals and rules can possibly give

adequate guidance in all the complex situations that can arise [13].

Sommerville [14] in his software engineering book denoted that: computer science is concerned with theory and fundamentals; system engineering is concerned with all aspects of computer-based systems development including hardware, software and process engineering; software engineering is concerned with the practicalities of developing and delivering useful software. Software engineers must accept that their job involves wider responsibilities than simply the application of technical skills. They must also behave in an ethical and moral responsible way if they are to be respect as professionals.

To understand the computer and software engineering ethics, we have to understand the concept of ethics, ethical problems and its role in human life. One of the recognizable and effective concept of ethics is the Islamic concept, which is still not studied broadly by computer and software engineering professionals.

II. ETHICAL PROBLEMS

The results of joining several conferences, having several discussions with experts and professionals, and reading different articles related to ethics can be concluded as: ethics have several definitions, which reflect the philosophers or authors viewpoints and their culture, but there is a common area between all these viewpoints. So ethics can be defined as “Set of principles of right conduct”, “Theory or system of moral values”, or “motivation based on ideas of right and wrong”.

Wikipedia encyclopedia [15] shows that: Socrates was one of the first Greek philosophers to encourage both scholars and the common citizen to turn their attention from the outside world to the condition of man. Aristotle posited an ethical system that may be termed "self-realizationism"; when a person acts in accordance with their nature and realizes their full potential, they will do good and be content.

People are daily facing ethical issues at their life; but how many of us know how to deal with them?. Several surveys were done which shows a whole array of issues being faced by employees such as: stealing, lying, fraud and deceit [16]. Internationally, the ethical values are also deficient. In a survey of 300 companies across the world, over 85% of senior executives indicated that the following issues were among their top ethical concerns: employee conflicts of interest, inappropriate gifts, sexual harassment, and unauthorized payments [17]. A survey of 2,000 major US corporations revealed that the following ethical problems concerned managers: drug and alcohol abuse, employee theft, conflicts of interest, quality control issues, discrimination in hiring and promotion, misuse of proprietary information, abuse of company expense accounts, plant closings and lay-offs, misuse of company assets, and environmental pollution [18].

In computer and software development, there are several problems related to ethical issues. These issues include professional responsibilities, social responsibility, quality as moral issue, software ownership and intellectual property rights, privacy, computer crimes,

confidentiality, responsibility and liability, professional competence, impact on society and work place, security and reliability, and safety [19]. Ethical related problems in computer and software are very costly, harmful and affected high ratio of people. A federal bureau of investigation (FBI) study shows that in 2006 the estimated computer crimes cost USD 67.2 billion yearly.

On the other hand, software engineers participate in developing advanced software as a core for all intelligent and mass-destruction weapons systems. The unethical usage of such weapons causes hundreds of thousands of innocent victims as well as the huge destructions for wealth and environment, which means that software engineers participates indirectly in such crimes and destructions.

A survey study done on internet's usage and ethical problems in education; the sample is selected from higher education institutions in Malaysia. Internets' users (students, academic staffs & non-academic staffs) represent different nations, races, cultures, genders, experiences, ages and qualifications; this makes the selected sample of users more representing the population that we need to study. Survey results show that:

- 73% of total users consider sexual related data is harmful data factor.
- 51% of total users consider Anti-religious related data is harmful data factor.
- 42% of total users consider Advertisements and commercial announcement related data is harmful data factor.
- 19% of total users consider Anti-Culture related data is harmful data factor.
- 19% of total users consider political related data is harmful data factor.
- 14% of total users consider security related data is harmful data factor.

It also shows that 75% of the users get such harmful data by e-mails.

III. ETHICS: AN ISLAMIC PERSPECTIVE

Islam is the last religion revealed by God (Allah-the almighty) to people. Allah said in Qur'an [20] "This day, I have perfected your religion for you, completed my favor upon you, and have chosen for you Islam as religion" [Quran 5:3]. Qur'an consists of more than 6000 verses; with hundreds of verses focusing on ethical aspects. Islam is basically based on two sources: The Holy Qur'an [20] and Sunnah of Prophet Mohammed (peace be upon him). Sunnah is mainly defined by Muslim scholars as "all what prophet Mohammed says, acts, or agreed on", which is mainly documented in six authenticated resources (*Sahih al-bukhari, Sahih Muslim, Sunan Abi-Daud, Jamea al-Termethi, Sunan Ibn-Maja, and Sunan al-Nisaae*).

The general understanding of ethics in Islam can be express as a "set of moral principles and guidance that recognizes what is right behavior from what is wrong or what one should do or not". Qur'an and Sunnah, show that all the Muslims' life should be guided by Islamic ethics [21- 24]. Allah said "Verily this Qur'an Doth guide

to that which is most right (or stable)” [Qur’an 17:9]. Allah uses the term Akhlaq or khuluq in the Holy Qur’an to refer to the ethics. The importance of ethics in Islam is shown when Allah prescribes Prophet Mohammed that he is with great ethics ”Prophet of Allah had been raised to a great spiritual dignity” [Qur’an 68:4]. Also Prophet Mohammed said “I was sent to complement the best of ethics”. The Qur’an represents the main dimension for the concept of ethics in Islam; when Aisha, the wife of Prophet, asked about the ethics of Prophet; she replied: “His ethic was al Qur’an” [21]. Allah orders the Muslims to follow and obey Prophet Mohammed as a model “You have indeed in the Messenger of Allah an excellent example” [Quran 33:21]. Allah describes people of the best nation as: “You are the best of peoples, evolved for mankind, enjoining what is right (Ma’ruf), forbidding what is wrong (Munkar), and believing in Allah” [Qur’an 3:110]. The Qur’an and Sunnah use set of ethical terms to describe the concept of goodness such as: Sidq (Truth), Khayr (Goodness), Birr (Righteousness), Qist (Equity), ‘Adl (Equilibrium and Justice), Haqq (Truth and Right), Ma’ruf (Known and approved), Amanah (Honesty), Ikhlas (Sincerity), and Taqwa (Piety). Pious actions are described as Salihat and impious actions are described as Sayyi’at. [25]; some of these terms are repeated in tens (10s) of Qur’anic verses as well as Sunnah. A survey result (term based frequency) for sample of ethical related terms used in Qur’an is shown in [26]. Table (1) shows a survey result (verse and hadith based frequency) for sample of ethical characteristics used in Qur’an and Authenticated resources of Sunnah [27].

TABLE 1
FREQUENCY OF GOOD ETHICAL CHARACTERISTICS IN QURAN AND SUNNAH

Good Ethical Characteristic	No. of Verses	No. of Hadith
Ihsan (beneficence)	66	29
Ikhlas (sincerity)	23	34
Istighfar & Tawba (forgiveness)	202	100
Amanah, Nazaha, Istiqama (honesty)	65	66
Iswa Hasana, Irshad Islah (good model & Guidance)	67	82
Wafaa Ahd, Ketman Ser (Keep promise and Secricy)	31	50
Amr maarof Nahi munkar (order goodness, prohibiting badness)	13	33
Eman & Taqwa (Believe & piety)	595	145
Morality, Husn alkhulug walmuamalah (good ethics and dealing)	61	250
Hikman & hulum (wisdom)	129	31
Alhamd, Alshukr, Althanaa (Thankfulness)	235	142
Sabr, Musabara, Kathm ghaidh (patient)	108	64
Adl, Insaf) (fairness)	23	62
Sidq (Truth)	92	44
Rahma, Raafa, Rifq (Mercyful)	227	124
Takrem Insan (Mankind priority)	96	24
Ilm , Amal (Science , Work)	530	139
Tafakr, Tadabr, Taaml (thinking)	83	48

These surveys show that Islam supports and rewards people for all goodness and warns, prohibits or punishes people for badness.

Historically; many of Muslim’s scientists and scholars have great effort in the field of ethics. They wrote many

books and articles to explain the concept of ethics in Islam. They consider ethics as the best honorable science or the crown of sciences, which leads to bring success, happiness for individuals, communities and society.

Alfairuzabady [28] and Ibn Mandhor [29] mention that linguistically ethics means your default behavior “tab’a or Sajiyah”, kindness (Moroa’a) or religion, which reflect the mankind natural characteristics that is straightforward consistent besides the acquired characteristics that became as natural characteristics [28- 31]. On the other hand Ibn Miskawah [32] and Abo-hamid Al-Ghazali [24] define ethics as a fixed situation of mankind soul and according to it, the mankind acts or behaves easily and simply without need for thinking or his acts become as default. Abd al-karim Zaydan [33] mentioned to ethics as set of fixed characteristics and meaningful values in mankind soul and according to the act consider accepted as good or rejected as bad so that he will perform or reject [31- 33].

Islam considers ethics as an essential factor in developing or rebuilding the society based on understanding of the Qur’an and Sunnah. This ethical rebuilding of human behavior will bring benefit, peace, and prosperity to mankind [34]. The ethical behavior affected by set of factors, which can be classified according to their level of effect into: Global, Nation, Community, family, and individual. Historically; Islamic system is the only system that produces encyclopedic scientists such as: Al-khawarizmi, Ibn-Rushd, Ibn-Hayyan, Ibn-Sena, Ibn-Albetar, and Ibn-Alhatham. Each one of them was scientists in several fields such as Fiqh, Hadith, Language and Art, Mathematic, chemistry, physics, Medicine, or astronomy. They were models and behave according to the Islamic Ethics

IV. THE NEED FOR ISLAMIC ETHICS

According to our experience, analysis of the literature and survey results of ethical terms in the Qur’an and the *Sunnah*; there is lack of knowledge and misunderstanding about Islam and Islamic ethics by many of non-Muslims as well as some of Muslims. This research is an attempt to remove this gap with software engineers as they are key factor in the success of software development, which has a big affect in human life. We can summarize the main characteristics for Islamic ethical principles as:

- Convert society to the best: Historically; Islamic ethical principles was tested in real life and shown that it is the suitable solution to convert society to the best. The clear example shown when Islam converts the Bedouin society in the Arab-land into modern society within two decades, then build a great nation, which leads and develop main part of world (with great ethics such as justice, fairness, honest, truth, goodness) as shown in the Umayyad, Abbasid and Andalusia eras.
- Comprehensive: Islamic ethics are comprehensive, which organize the relation between: mankind and Allah, mankind them self, mankind and other creates of Allah, and mankind and environment. Allah said to Prophet “We have not send thee but as messenger to

all mankind, giving them Glad tidings, and warning them against sin" [Qur'an 34:28], also "We send thee not, but as Mercy for all creatures" [Qur'an 21:107].

- Stable: Islamic ethical principles are stable and standard. It deals with people in justice, fairness and equality regardless of their race, relationship, nation, religion, or color. Allah said "Verily this Qur'an Doth guide to that which is most right (or stable)" [Qur'an 17:9]. Prophet SAAW said "all people are equals, there is no difference between Arabic and non-Arabic except in Taqwa (Piety).
- Activating the purity: Islamic ethical principles work toward reactivating the purity (Fit'ra) of people as they created by Allah SWT and out of devil's affect. "So set your face towards the religion of pure Islamic monotheism; Allah's Fitra with which he has created mankind" [Qur'an 30:30].
- Whole life guidance: Islamic ethics rebuild the society through building individuals; starting from day of birth and continue through all his life.
- Associated principles with implementation: Islamic methodology of life is guided by Islamic ethics. It associated theoretical principles with implementation through set of worshipping and dealing acts. There are more than fifty verses in Qur'an mentioned to "those who believe and do deeds of righteousness".
- Associate acts with intension: Islamic ethical principles associate mankind acts with his intension, which is known by Allah. "Except as Allah wills; for he knoweth what is manifest and what is hidden" [Qur'an 87:7]. Prophet said "All your acts are associated with your intentions".
- Challenge with devil: Islam considers human life is a challenge between mankind and devil. Allah supports the mankind with forgiveness and mercy using (Tawba and Isteghfir). Also Allah duplicating rewards for good deeds and canceling sins when we make Istighfar or Tawba. "Verily devil (Satan) is an enemy to you: so treat him as enemy" [Qur'an 35:6]; also "Allah who forgiveth Sin, accepteth repentance" [Qur'an 40:3].

The unethical behavior for some Muslims can be consider as one of the essential reasons for their weakness, which also leads to the unfair concept about Islam and Islamic ethics by some of the non-Muslims.

Several lectures and articles show that Muslims' population is approximately 1.5 billions which represent more than 20% of the whole world population. They are distributed mainly in more than 60 countries. They are dealing with computer and IT related applications directly or indirectly. Yearly; many Muslims are graduated from computer and Information Technology programs within hundreds of universities in Islamic world and other universities as well as training centers. This offers tens of thousands (10000s) of Muslims as computer and software engineering professionals. This shows that the Muslims especially the software engineering professionals should have an effective role in computer and software engineering field and its related code of ethics.

Conferences, discussions, and literature reviews show that Muslims' researchers have simple effort in computer and software engineering ethics and they still not adopted standard code of ethics based on Islamic values. Also there is lack of efficient and effective: comprehensive database, e-learning tool, and textbooks related to Islamic ethical values in computer and software engineering.

V. ETHICS FOR SOFTWARE ENGINEERING PROFESSIONALS

Software engineering professionals have specialized knowledge and often have positions with authority and respect in the community so, they are able to have a significant impact upon the world, including many of the things that people value [35]. Computer professionals find themselves in a variety of professional relationships with other people [36, 37] that involve a diversity of interests, and sometimes these interests can come into conflict with each other. Professional organizations in USA, like ACM (Association for Computing Machinery) and IEEE (Institute of Electrical and Electronic Engineers), have established codes of ethics, curriculum guidelines and accreditation requirements to help computer professionals understand and manage ethical responsibilities. In addition, both the ACM and IEEE have adopted Codes of Ethics for their members [14]. ABET (Accreditation Board for Engineering Technologies) has long required an ethics component in the computer engineering curriculum. In 1991, CSAC/CSAB (Computer Sciences Accreditation Board) also adopted the requirement that a significant component of computer ethics be included in any computer sciences degree granting program that is US accredited. IEEE and ACM are two of the main professional committees in field of computer and engineering. They work toward define standard principles for software engineer in term of professional and code of ethics. They produce early versions and try to upgrade it from time to time. Major revisions were made between version 3.0 that was widely distributed and version 5.2, the recently approved version [19]. The preamble was significantly revised to include specific standards that can help professionals make ethical decisions. The short version of the code summarizes aspirations at a high level of abstraction. Software engineers shall commit them-selves to making the analysis, specification, design, development, testing, and maintenance of software a beneficial and respected profession. In accordance with their commitment to the health, safety, and welfare of the public, software engineers shall adhere to eight Principles [38].

However, codes of ethics suffer from limitations in the rough-and-tumble of real world. Codes lay out general ideals of ethical behavior, and often establish specific rules for commonly encountered situations [13]. Edmund G. Seebauer and Robert L. Barry mentioned that, no list of ideals and rules can possibly give adequate guidance in all the complex situations that can arise. Shades of gray abound, and the best way to apply ideals and norms may not be obvious. Furthermore, focusing only on the specific rules in codes some times leads to ethical

minimalism, which is the idea: „if it’s not specifically forbidden, it must be allowed“. In addition, some situations call for quick decisions, with no time to consult a “rule book“ of any sort. Worst yet, often no “traffic cop“ is around to blow the whistle on code violations. Finally, certain formal ethical standards can change with time, some times in response to legal decisions [13].

We can summarize the results of LR and survey for the ethical related problems for software engineering professionals as:

- Although there is big effort done by many international organizations but we still have several problems related to ethics in computer and software engineering.
- The ethical principles are based on society, community, employee interest, which is changeable from time to time based of some people concept. This leads to a lot of conflict and corruption cased by leaders, scholars, scientists, or people who should be responsible; especially when such people force others to follow them.
- Misunderstanding of ethical concept and legality so that many people still consider following legal rules is not always means we work ethically.
- Many of the software engineering professionals are still participating in developing software to support many of computer-based system that cause huge destruction for human, health, wealth and environment.
- There is no standard code of ethics or principles for software engineering professionals based on Islamic values.
- Lack of people knowledge (especially software engineering professionals, students and lecturers) about real Islamic ethical values and capability of implementing it in real life.
- Lack of dedicated Database and e-learning tool for Islamic ethical values.
- Lack of Guidelines to enhance curriculum with Islamic ethical values especially for software engineering related courses.
- There is no Ethical Evaluation Model for software engineering professionals based on the defined Islamic code of ethics.

VI. MODELING SOFTWARE ENGINEERING PRINCIPLES BASED ON ISLAMIC ETHICAL VALUES

To solve the ethical related problems for software engineering professionals and to help Muslims to understand the Islamic ethics we proposes this framework for modeling software engineering ethical principles based on Islamic values as shown in figures (1, 2).

The framework model consists of three phases:

1. Phase I

- Preparing a Literature review, statistical survey and analytical study to determine: current situation of ethical related problems in SWE, current situation of codes of ethics or ethical principles for SWE professionals, the Islamic ethics and values based on Quran and Sunnah.

- Identifying (preliminary) Ethics principles for SWE professionals based on Islamic values.

Figure (1) shows the phase I.

2. Phase II:

- Expanding the LR, survey and analyzing phase I results to enhance it.
- Developing a comprehensive Database and Web-based E-learning tool for Ethics, Islamic ethics, and principles for SWE professional ethical values which offer ethical guidelines for a high ratio of people, especially 1.5 Billion Muslims with 10ths of thousands of SWE professionals to guide them in their work and life based on Islamic values.
- Defining a comprehensive guideline to enhance curriculum with ethics and producing enhanced SWE courses’ outlines based on Islamic ethical values.
- Developing an effective evaluation model (mathematical / statistical) for SWE professionals based on Islamic ethical values as a supportive tool for SW quality management.

Figure (2) shows the phase II.

3. Phase III:

- Testing and evaluating phase II products (database, e-learning tool, and evaluation model).
- Enhancing products according to testing and evaluation results.
- Publication and Commercialization the products.

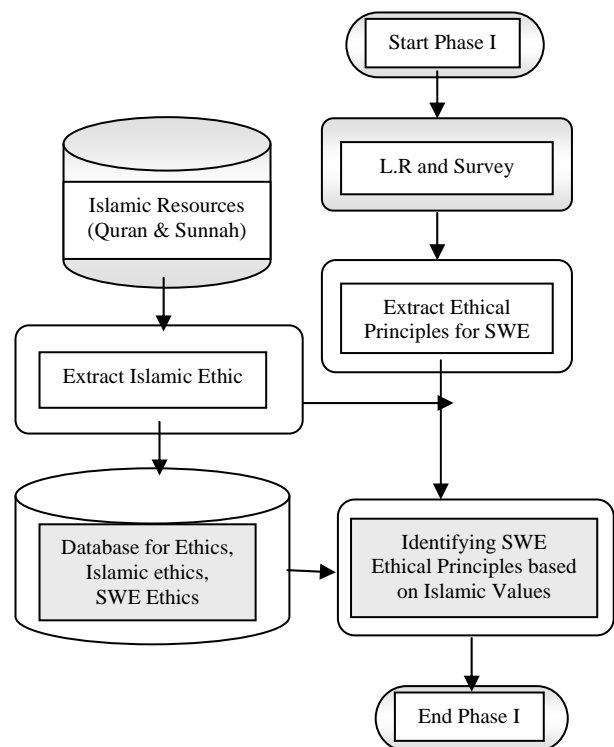


Figure 1. Phase I (modeling SWE ethical principles)

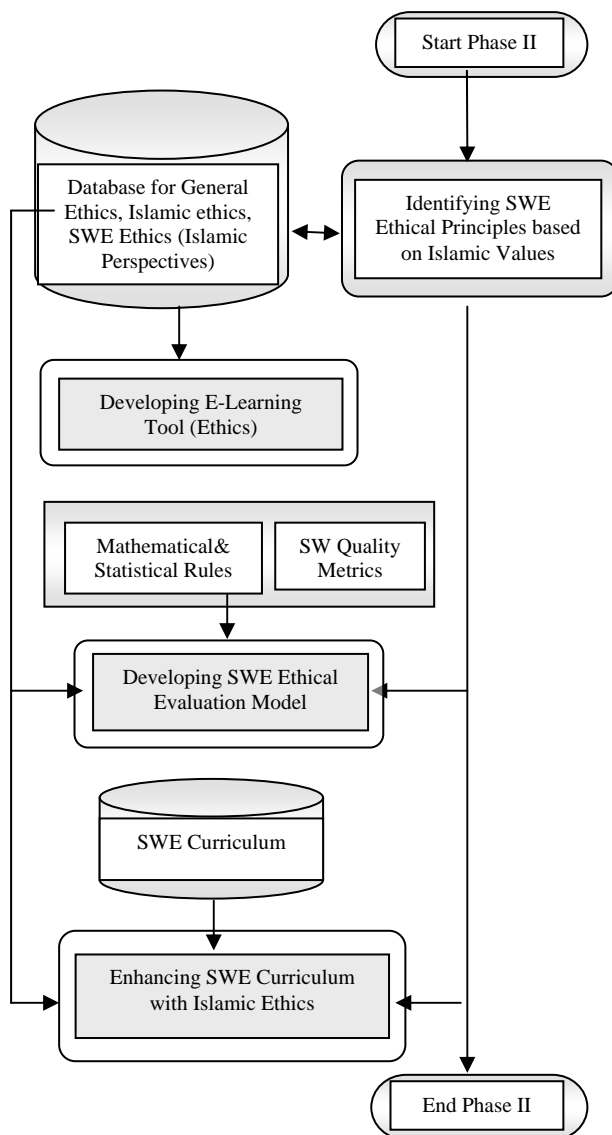


Figure 2. Phase II (modeling SWE ethical principles)

The main objectives for this framework can be summarized as:

- Offering solutions for some of the problems related to ethics in software engineering.
- Offering standard code of ethics or principles for software engineering professionals based on Islamic ethical values.
- Offering a suitable advising and warning for software engineering professionals to avoid participation directly or indirectly in harming of innocents or destruction of health, wealth and environment.
- Offering a valuable knowledge about real Islamic ethics to clarify the current cloudy picture about Islam or Islamic ethics, especially by the non-Muslims.
- Offering a comprehensive database and Web-based E-learning tool for ethics, Islamic ethics, and software engineering professional ethical principles which offer ethical guidelines for a high ratio of

people, especially 1.5 Billion Muslims with 10ths of thousands of computer and software engineering professionals to guide them in their work and life based on Islamic values.

- Offering guidelines for curriculum developer to enhance computer and software engineering courses with Islamic ethical values.
- Offering an effective mathematical / statistical evaluation model for Software engineering based on Islamic ethical values, which is a supportive tool for SW quality management.
- Offering a path or guidance for people specially the software engineering professionals to reactivate their good ethics and show them how to implement theoretical aspects of good ethics practically.

In this research paper we focus on defining and adopting a new (Novel) version of software engineering ethical principles based on Islamic values. The other objectives will appear later in other publications.

VII. SOFTWARE ENGINEERING ETHICAL PRINCIPLES BASED ON ISLAMIC VALUES: FRAMEWORK

This research paper work toward defining novel version of standard code of ethics or principles for SWE professional based on Islamic ethical values. It represents the integration between the Islamic ethics (according to Qur'an and Sunnah) and current software engineering professionals' ethical principles. Section 3 and 4 in this paper summarize: the concept of ethics in Islam, its importance in enhancing individual's behavior, and its main characteristics. Software engineering professionals have to commit them-selves to follow these principles in all software development phases: communications, data collection, analysis and requirements, design and specifications, construction, testing and maintenance.

The proposed ethical principles are guidance for software engineering professionals; especially the Muslims can be divided to two parts:

A. General principles:

This set of principles is for all mankind (including computer and software professionals). it includes:

- Work as vicegerent of Allah: The main objective of creating all mankind by God (Allah) is to warship him; by developing and reconstructing the earth for the best (as vicegerent or Caliph) through their good acting and deeds. Allah said "I have only created Jinn and Men, that they may serve me" [Qur'an 51:56]. "Allah they Lord said to the angels: I will create a vicegerent on earth" [Qur'an 2:30].
- Spend your age in performing goodness and collect your wealth in ethically legal ways: The age and wealth for any mankind are predetermined and fixed by Allah before they born; but they are responsible for their acts and decisions as shown in the following verses of Qur'an. "To every people is a term appointed: when their term is reached, not an hour can they cause delay, nor an hour can they advance"

[Quran 7:34]. "For them a substance determined" [Qur'an 37:41], "there is no moving creature on the earth but its sustenance dependeth on Allah" [Qur'an 11:6]. "verily, we showed him the way, weather he be grateful or ungrateful" [Qur'an 29:3].

- No secret act and each act associate with intention: God (Allah) knows all what we declared or keep it secretes as well as all our acts are associated with our intentions (Niyyah); so we have to be clear in our work. "Allah he kneweth what manifest and what hidden" [Qur'an 87:7]. Prophet said "All your acts are associated with your intention".
- Performing duty is a warship: Software engineering professionals have to know that, performing their duty is a warship and Allah will reward them for goodness and punish them for badness. Allah said in Qur'an "Then shall anyone who has done an atom's weight of good, see it and anyone who has done an atom's weight of evil, shall see it" [Qur'an 99:7-8]. Prophet in his Hadith said "work is warship".
- Understand and follow the standard ethics, specially Islamic ethics: Software engineering professionals have to understand the standard Islamic ethics (based on Quran and Sunnah). They have to consider it as the highest standard that they should follow in their life and work. "Verily this Qur'an Doth guide to that which is most right (or stable)" [Qur'an 17:9]. "The religion be for Allah is Islam" [Quran 3:19].
- Remember the Judgment day: Software engineering professionals have to know that doing goodness and producing useful knowledge will be rewarded by Allah in their life and after death to the Day of Judgment.

B. *Dedicated principles:*

This set of principles is dedicated for software engineering professionals. It is an enhanced version for IEEE / ACM version. it includes:

- Work in consistent with goodness of Ummah or nation interests: Software engineering professionals have to work consistently with the Ummah (nation) interest, which are based on Islamic ethical values and should not make harm for it. "Every Muslim is shepherd (leader) and he is responsible for that which he shepherds".
- Work in consistent with goodness of community or organization interests: Software engineering professionals have to work in a manner that is in the best interests to their community or organization and in consistent with the nation interest based on Islamic standards. Prophet in his Hadith said "those who cheat us are not part of us (our Ummah)".
- Meet the highest professional: Software engineering professionals have to ensure that their products and related modifications meet the highest professional standards and not conflict with ethical values. Prophet in a Qudsi's Hadith said "Allah love those who accomplish their job in its best (perfect) manner".

- Fair judgment: Software engineering professionals have to maintain integrity and independence in their professional judgment and have to be fair according to ethical values. Allah Said in Qur'an "when you judge between others you judge with justice". [Qur'an 4:58]
- Management with honesty: Software engineering professional managers and leaders have to subscribe to and promote an ethical approach to the management of software development and maintenance. They have to show the honesty (Amanah) and equity in performing their duty.
- Work with highest profession: Software engineering professionals have to advance the integrity and reputation of the profession consistent with the Ummah (Nation) interest. They have to do their best using their highest profession.
- Be cooperative and supportive: Software engineering professionals have to be fair to and supportive of their colleagues and avoid the selfish. Allah mention in Qur'an: "Help you one another in virtue, righteousness and piety (Bir and Taqwa); but do not help one another in sin and transgression" [Qur'an 5:2].
- lifelong learning: Software engineering professionals have to participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession. Prophet said "seek knowledge from birth to death".
- Protect the confidentiality: Software engineering professionals have to protect the confidentiality and security for the client, employer or community and nation (Ummah).

VIII.

CONCLUSION

Software is the core for any computer-based system, which affect all aspects of our life. Software development is a complex, expensive, and ethical engineering task which requires qualified software engineering professionally and ethically. Although ethical and professional principles for software engineering professionals were adopted by professional organizations and committees such as IEEE, ACM, ABET; but LR., studies and survey results show that software engineering professionals still facing many ethical related problems. Islamic sources (Holy Qur'an and Sunnah) provide a high standard of ethics for individual, communities and Ummah (nation) levels. Islamic ethics are stable, comprehensive, fair and standard which are suitable for all nations and times; and when followed leads to create an ethically great society. Since there is lack of effort in considering Islamic ethics in software engineering principles; this paper proposes a framework and roadmap for modeling software engineering ethical principles based on Islamic values. The paper adopting the main roadmap steps as well as the new principles for software engineering, which based on Islamic ethical values. This effort can help in solving many of the current ethical related software development problems. It offers a good opportunity for software engineers specially Muslims to

understand and implement such standard and comprehensive ethical values in their life as well as having their right role in software development.

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Dr. Shihab A.Hameed obtained his Ph.D in Software Engineering from UKM University. He has three decades of industrial and educational experience. His research interest is mainly in the software engineering, ethics, software quality, surveillance and monitoring systems, healthcare and medication. He is currently senior Assistant Professor in electrical and computer engineering, International Islamic University Malaysia. Dr. Hameed supervising numerous funded research projects, Ph.D and Master students. He has more than 60 papers published in various international and national journals and conferences. He is Senior Member IEEE and member of several professional societies.