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Flood Management, Flood Forecasting and Warning System

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Abstract: Flood phenomenon annually causes many human and financial losses so that flood has even had many losses in countries which are properly developed in river bank protection and construction of reservoir dams aiming to control flood. Today, controlling flood through its management is discussed and one of efficient and effective tools in this field is non-structural flood management as the complementary of structural ones that can have a very important role in controlling flood and consequently reducing the losses derived by that. Flood forecasting and warning systems are considered as one of the non-structural management tools which has given high importance within recent decades and providing information about flood and fast and easy reaction after receiving mentioned information to have minimum losses in flood areas as well as providing some information to manage water resources are of the aims of this system.

Keywords: controlling flood, flood forecasting and warning, flood non-structural management

1. INTRODUCTION

The relevant problems to the flood are various and have very complicated nature. In spite of all efforts all along history to inhibit and reduce flood damages through physical methods by people or governments, no country has been able to keep its flood areas completely safe regardless having assets and technology development. Due to this in some recent decades, non-structural strategies of flood management have drawn the attentions to moderate the losses of flood.

One of effective and efficient methods in non-structural flood management is providing and implementing a forecasting and warning system in catchment area that has been considered these days as an effective component on comprehensive management of flood and form a part of flood management of areas. Forecasting flood before its occurrence and warning the residents along rivers as well as authorities and responsible organizations in flood management give an opportunity to make decision about taking necessary measures such as planning for evacuation and displacement of people from dangerous areas, dams' reservoirs management and setting floods in dams as well as providing aid programs and doing other emergency measures in crisis. Identification and predicting of flood, warning and informing about the danger of flood, the program of necessary reaction in crisis, retrieval program after flood as well as interconnected management of system are considered as some sections of a flood warning system that among them predicting flood is one of the most important and meanwhile most complicated one and it is also regraded as important factor in the rate of system success.

2. FLOOD MNAGEMENT STRATEGIES

Flood management refers to the processes in inhibiting flood which moderate expansion of flood and the losses derived by that. Today considering the number of occurred floods in the world and the damages finically and life losses, its importance and inhibiting it have been more clarified. The related statistics to the damages of occurred floods and great expense which controlling the floods imposes on governments show that controlling all these floods is impossible and its losses can only be minimized through taking proper management strategies (structured and non-structured) [1]. Hamedi et al. proposed a structured method to minimize the flood effect to downstream of the dam properties by inclined the steps on the stepped chutes [2]. The effect of end sill to reduce the energy dissipation of the stepped spillways and protect the downstream of the dam from flood is also considered by Hamedi et al. [3]. They reported that using this structured method will reduce the flood destructive energy and will protect the downstream [3].

Shifting the attitude about flood management from structural methods to non-structural ones can be seen in recent years and this kind of attitude is a part of sustainable development principles. That is when a system of flood protection is established or modified to provide our needs, the principle of sustainable development commits us to be careful about future generations and their needs and consider that future generation might have other information which is unknown to us and because of that the solutions of flood management shouldn't be only as non-moving giant concrete structures or the ones which constantly break down [4].

Key point about different non-structural solutions is their synergic potential because effective function of these methods is the result of using them concurrently. Reaction measures without planning will obviously lack the necessary efficiency. Due to this, optimum synergy of non-structural and structural methods needs particular attention. Generally, of the reasons for the importance of completing structural methods using non-structural methods, the following cases can be mentioned [5]:

- Lack of complete certainty about the performance of structures considering existing uncertainties as well as implementation shortcomings
- Creating severe changes in hydro systems because of human activities human activities in recent decades and increasing slow process of natural changes in terms of this

- Better matching non-structural methods with technological advance that can be a tool for coping the harmful effects of hydro systems changes and using their supplies
- Applying non-structural methods is the only possible item while structure is constructed. This period can be long in very big plans and economically, reducing damages in initial years is more important than later years. Increasing the period of flood returning, designing and increasing the dimensions of structure in long-term can make the dangers of flood double because destruction of giant structures will usually have much disastrous consequent compared to when there is no structure at all.
- In many cases, restricting river path will bring undesired environmental consequences. Due to this, minimizing the dimensions of structures using combining structural and non-structural methods is desired.
- One fundamental principle in river engineering is gradual modification of river considering the response of river and mainly using the energy of flow that is aligned to fast construction of flood management structures. Non-structural methods can make more compliance between river engineering and flood management through reducing the dimensions of structures.
- In many cases non-structural methods are the only possible items such as warning and evacuating people in giant waves caused by tsunami in the shores or sea storms or breaking the dams
- Creating better recognition of hydro systems and its changes using non0structural methods and the possibility of better leading and compliance [5].

3. FLOOD WARNING AND FORECASTING SYSTEMS

Reducing the losses caused by flood using non-structural methods is a modern approach in flood management and flood warning system is one of them that has been used in some of countries in the world [6].

The importance of using these systems will be clear when using them in Bangladesh has caused 99% reduction of human losses in 1997 compared to 1991 so warning flood is discussed as one of the most effective non-structural methods of flood management in order to manage crisis and reduce human and financial losses [7].

As one of flood management methods through predicting the time, severity and volume of fluid in catchment area, flood warning systems have significant role in reducing the damages of flood one hand and applying proper scenarios of exploiting water supplies of catchment area on the other hand [8].

One of motives for creating flood warning systems of rivers is reducing the damages of flood through warning the residents of flood areas and determining the real time exploitation of constructed dams on the rivers. Taking emergency actions and providing progressed information about flood is the initial aim of this system so that after receiving this information, it can be easily and quickly reacted. The second important aim of flood warning system is providing some information for managing water supplies. Therefore, the information of flood warning systems can be used for daily making decisions in allocating water supplies. Initial aims of flood warning system include:

- Reducing damages to people’s life and property cause by flood
- Reducing disorder in business and human activities

For achieving high goals, the measures below should be taken:

- Improving and maintaining an effective communicational system between organizations and people
- Public participation and planning fast reaction to the danger
- Public training to react against flood according to predicting and warning sudden floods
- Making floodplain more effective and better
- Minimizing the time of reaction after broadcasting sudden flood [9]

In most of developed flood warning systems, forecasting system of flood acts smartly, in monitoring system, climate conditions are assessed in real time and continuously. By activating flood forecasting model, flood hydrograph is predicted in the points of goals. The results of forecasting will be given to crisis management organization and they make decisions about warning and informing people. General structure and schematic design of flood warning system has been proposed in figure 1.

Conducted researches all around the world show different flood warning systems in different countries. This indicates that depending on the conditions of catchment, its hydrologic complication and different methods and goals, the system can have different efficiencies [5]. A flood warning system consists of different sub systems such as flood forecasting and identification sub system, flood warning sub system and emergency reaction sub system.

4. PREDICTING PRECIPITATION AND FLOOD

Hydrologic forecasting is estimating future status of a hydrologic phenomenon and the value of a forecasting depends on its accuracy to the great extent; required accuracy should be also proper with required function. Of the uncertainty factors in hydrologic forecasting, measurement errors, model restrictions and natural changeability of climate input to hydrologic systems can be mentioned [5].

In terms of dimensions and the speed of occurrence, the floods are divided into two categories of flash and river floods. Flash floods occur within a short time after raining (one or some hours) and happen in small steep basin. In terms of occurrence factors, these floods are complicated and due to effectiveness, they also cause many human and financial losses. Two factors of precipitation intensity and regional hydrology are important in the harsh floods. Flood forecasting and warning is very complicated and difficult due to low time between starting precipitation and the occurrence of flood and time is a restricting factor. The best mode of warning in this type of flood is estimating quantitative precipitation forecasting (QPF) through the meteorological methods and then the dimensions of flood are forecasted using precipitation-runoff models. But such facilities and data in small catchments aren’t available [10] and [11]. Therefore, flood warning system in these catchments include forecasting or collecting precipitation data before or while precipitation as well as a model which can estimate flood and runoff caused by that.

In river floods that often occur along main rivers and in big areas, the effect of flood routing in reservoirs and dams as well as floodplains is considerable. In this mode, time isn't restricting factors in forecasting and can take several hours or several days. So in addition to the severity of precipitation and watershed hydrology (the factors such as physical characteristics and …), watershed and river hydraulic and

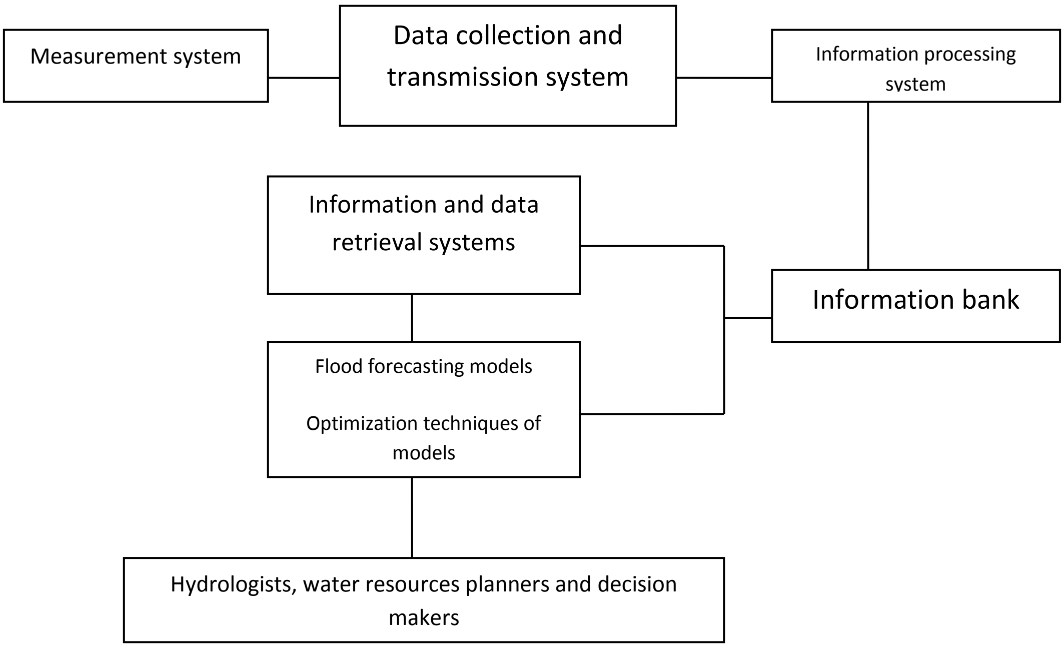

Figure 1. general structure of flood warning [12]

physical process of flow such as filling and emptying the tanks, water deviation from channels, dams and … are also effective on flood problem. Flood warning technique in these catchments include forecasting precipitation before or collecting that in real time, converting forecasted precipitation or observation to flood, flood routing in river and reservoirs using one of hydraulic or regression methods and estimating flood in target points, following that, necessary information will be given [13].

Regardless the type and dimensions of flood, the following measures should be taken in predicting flood in a flood warning system [14] and [15].

- Providing precipitation-runoff model and hydrograph of flood created by forecasted and observed precipitation
- Routing forecasted flood in different points and determining the aspects and size of flood

Precipitation forecasting is one of the most difficult phenomena of hydrologic cycle because of high changes in time and location scale [10] and [16]. Forecasting precipitation is expected in different scales of high short time (up to 12 hours), short time (12 hours to 4 days), middle time (4 days up to one month) and ling time (seasonal, annual and climate periods). Precipitation forecasts used to be done through synoptic methods in the past in which forecasting was qualitative and in big scale based on experience. Today, along technologic progresses and using systems and tools such as satellite, radar and supercomputers and also using experts' experiences, significant developments have been achieved in perceiving and analyzing atmosphere phenomena, exchanges and atmosphere cycles and as result forecasting precipitations especially quantitative and numerical precipitations during different time periods.

Short term precipitation has an important role in time interval of 0-6 hours or maximum daily in flood warning. In flood warning system forecasting QPF very short time or generally short time in the scale of a catchment is required. Using QPF in forecasting the flow of rivers lets the time of forecasting and the efficiency of forecasting and warning flood to be increased [16]. Forecasting very short time precipitation about 0-6 hours and with high transparency in place and time is often described as Nowcasting [17]. Dominant methods of forecasting short time QPF involve some factors such as numerical weather prediction models, observation based methods and numerical predictions (Blended system).

Among the methods above, numerical weather prediction (NWP) proposes the amount of precipitation quantitatively after doing post-processing operations and a specific time. Some models such as ARPS, ECMWF, MRF, WRF, MM5 and ETA are some kinds of mentions models. In terms of scale, these models are divided into two categories of global and regional categories. In terms of time scale as well as grid size the prediction is different.

The results of QPF of numerical prediction models are in the scale of big catchments and with high time step and practically the hydrologists can use a part of these information because for warning flood in small catchments or flash floods, they need QPF with high spatial resolution in the levels of 100 square kilometers and less and time step of one hour, therefore, using numerical models without localization is restricted due to some reasons such as restriction in minimizing the networks (e.g. up to 5*5 km) and restriction in reducing forecasting time step.

To use the results of this model in small catchments, downscaling operations are conducted and through post processing measures (correcting output error of forecasting dynamic models for parameters of each level) the results of big scale numerical models will turn to integrated and short-term precipitation in the catchment using regression models. In most of numerical models, neural networks as processing and also their calibration with ground rain-gauge data have been used and known as a strong tool in this field [10] and [18].

Today, executive agencies of America and Europe have used some methods of numerical methods that simulate precipitation less than 6 hours in bigger catchments than 1000 square km using integrated and contextual models [19] and [16].

5. DIFFERENT TYPES OF FLOOD WARNING SYSTEMS

Considering the type and technology capability which is used in its different parts in different levels of assessing base data, sending data, processing as well as how the flood is predicted, flood warning systems are divided into two general types of manual and automatic. Manual flood warning regional systems are of the least expensive and simplest systems and in primary type, using the services of volunteers and simple rain-gauge (plastic) and scale (rating level) in sensitive areas, they report their observations to coordinator of system while an automatic regional flood warning system consists of a network of different evaluators that report atmosphere and environmental conditions to a central computer.

An automatic flood warning system is usually able to act as a standalone system or in the form of a network and include some equipment such as fully automatic transmitter evaluators, a communication system and safe communication, automatic information collection and processor system and proper computer hardware. The components of an automatic regional flood warning system cannot be designed and implemented separately or without necessary coordination. This important issue is one of base requirements in equipping the area with automatic flood warning system [5].

Integrated and comprehensive flood warning systems are created through combining and integrating regional flood warning systems through making connection and interaction among them (exchanging two-way information) and are efficient in national or even international scale. This relationship is managed and coordinated from a country flood warning center by an equipped computer system [5].

6. DECISION MAKING SUPPORT SYSTEM IN REAL TIME

Decision making support system is a system consisting of software sub-systems and based on model and database and information that totally helps increasing the efficiency of decision makers in doing semi-structural responsibilities. Therefore, the first role of a decision making support system is helping the decision maker in the process of judgement and decision making about problems which haven't been defined well [20]. Mentioned system has different components and levels which work connected to each other and generally help managers to make decisions [21]. Champiri et al. had extensive researches to build decision and evaluation systems for marine structures which may be affected by different environmental hazards [20, 22].

Operationally, decision making support systems can be investigated in four levels of collecting data and information, existing solutions to solve problems, choosing the best item for solving problem as well as revising selected item in terms of implementation and relevance to the issue. The following cases are recommended for operationalizing a good decision making support system:

- Producing precipitation using meteorological models or through weather radar images
- Graphics of precipitation forecasts for probable accidents with big scale
- Simulation for predicting the hydrograph of water level balance in different points using hydraulic and hydrologic models
- Comparing all balances of water level related to time series with threshold water balances in order to analyze flood risk in time interval of prediction
- Determining peak balances of water level in prediction time period and at the times of reaching peak balances
- Providing graphical output display through connecting to graphical user of decision making support system as the layers of GIS map
- Providing relevant phrases to flood using initial format of flood phrase and creating code of HTML for public access to mentioned phrases using internet
- Analyzing investigated results in case of requiring warnings probable issuing to relevant authorities
- Transmitting predictions into standard databases system for documentation
- Issuing warning using available telecommunications and electronic tools
- Revising monitoring system to confirm the situation as well as be prepared for organizing activity [5]

7. EMERGENCY REACTION SYSTEM

The operation of reacting to flood can be managed through three methods below:

- Determining an organization for coping with flood: the operations are managed by operational leader of organization who act as flood operation manager.
- A general structure of emergency conditions management: operations are managed by a person in a particular control conditions with emergency management structure
- A combination of two methods above

According to global experiences, the management of emergency conditions of coping with unexpected events in the form of a national and integrated organization has had the best efficiency. Simply, flood is only one of precarious set of events that a developed nation should prepare the program for coping with. When they are located in a set of a multi-dimensional emergency coping comprehensive plan, emergency preparedness and coping with flood networks can take advantage of existing organizational systems and structures and through gathering the resources and experts in a complex, some measures can be taken to reduce the dangers of natural disasters such as storm, earthquake and flood and save organizational economy and cost.

In third mode that operation management is by a combination of mentioned cases above, the operations are managed by a person who is manager of flood operations, inside the structure of emergency management. The organizations of coping with flood are nominated for doing particular measures and they do them as the manager of emergency cases lead them generally. Choosing reaction management system significantly depends on general system of emergency management [5].

Emergency action plan (EAP) is an official document that follow a predesigned particular operation in order to minimize human and financial losses. This plan includes the methods and information to help a qualified person for releasing pre warnings and warning messages to the authorities of emergency cases management and to determine the actions which a qualified person should do in order to reduce relevant problems to the flood. Each emergency action plan should be provided for the location conditions considering all relevant features. Emergency action plans generally include 6 main components of warning diagram, discovering and classifying emergency situation, accountability, preparedness and flooded maps [5].

8. REHABILITATION SYSTEM AFTER FLOOD

Organizing implies on returning fundamental services to the performances before accident, helping people for self-sufficiency and self-confidence, repairing damages, giving financial facilities, rehabilitating economic activities and providing the fields of supporting the survivors mentally and socially while rebuilding include providing whole services and damaged infrastructures, replacing destructed buildings, rehabilitating economic activities and finally improving environmental conditions of affected community. During rehabilitating operation, some activities can be established to reduce the effects of future floods as follows:

- Conducting studies and social surveys for exploiting the attitudes of flood management and its later consequences to acquire information related to re-planning of strategies of people and assets and promoting the level of rehabilitation operation in future
- Conducting the studies of flood damages not only for determining the damages which have been occurred but also for avoiding the damages due to implementing the plans and individual and social activities
- Conducting the studies of economic effects in order to determine and localize the houses and states that get flooded frequently. These studies should be followed to the extent of turning a social responsibility
- Revising construction rules and land-use zoning to ensure constructions have been reinforced properly and also encouraging the owners for anti-flooding (keeping safe against floods) through reinforcing or other measures [5].

Also, considering that some components of flood warning and forecasting system are vulnerable against flood, probable damages on flood warning and forecasting system are necessary to be eliminated as soon as possible and the system need to be prepared for forecasting and warning likely later floods. Besides these methods, artificial intelligence and machine learning as a quick and powerful tool [23-25] can be used to predict and manage the flood. Bardestani et al. used ANFIS which is a combination of Neural Network and Fuzzy Logic in Water Resources [26].

9. CONTINUES MANAGEMENT SYSTEM

Reviewing and revising flood warning system, verification of forecasting models in a decision making support system, the programs and maneuvers of organizations for revising and reviewing the system, exploitation, planning and maintaining as well as developing flood warning comprehensive system can be considered as the goal of this system.

10. CONCLUSION

Using simple and applicable management methods especially for forecasting flood can be considered as the first step for developing flood management complicated systems and flood warning system is one of several non-structural methods which have been used to reduce flood. Forecasting flood before occurrence and warning the residents along rivers as well as authorities and responsible organizations in flood management give an opportunity to make decision about taking necessary measures such as planning for evacuation and displacement of people from dangerous areas, dams' reservoirs management and setting floods in dams as well as providing aid programs and doing other emergency measures in crisis and one of important aspect in this case is responsibility of different organizations involved in designing, developing, completing and exploiting flood warning system and in case there is no strategic organization, achieving this won't be easy.

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Municipal Solid Waste Management Challenges and Problems for Cities in Low-Income and Developing Countries

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Abstract: Solid waste management is a challenge, problem as well as opportunities for the cities' authorities in developing countries especially low-income ones mostly because of the enhancing generation of waste, the burden posed on the budget of municipalities as a consequence of the high expenses belonged to its management, absence of the perception over a variety of factors which affect the various stages of management of waste and linkage essential to provide the whole handling system functioning. The data and information provided is very beneficial for changing, implementing or planning waste management system in towns. This article brings a general overview of state of municipal solid waste management (MSWM) by domestic authorities and available condition and current challenges of solid waste management (SWM) in developing countries particularly low-income ones. In addition, approaches of feasible solution which can be undertaken to prosper municipal solid waste (MSW) services are discussed. Approximately poor economic growth of the low-income developing countries annually has resulted in a rise in the poverty levels. Besides, migration from rural zones to urban zones has resulted in an unplanned settlements in suburban areas accommodation. Furthermore political interference prevents the smooth running of the domestic authorities. Vulnerability of surface and groundwater pollution is increasing due to lack of surveillance of local authorities in considering the environmental impact in siting MSW disposal sites. Illicit dumping of MSW on the roadside or river banks demonstrates economic and environmental threats on suburb properties. There are also lack of servicing of MSW collection vehicles, poor state of infrastructure and inadequate funding and budget which fight against the optimization of MSW disposal service. The rural economy requires to be developed if the migration of rural-urban areas is to be handled. In addition, involvement of stakeholders is necessary to obtain any meaningful and sustainable municipal solid waste management. Successful usage of low-tech approaches, and the association of informal refuse scavengers and collectors exist in different Asian, African and Latin American towns. Besides, a decentralized system can help solve the apparently intractable challenges and problems of waste management in low-income developing country cities in a socially favorable, economically viable, and environmentally sound manner.

Keywords: Solid Waste Management, Stakeholders, Low income, NGOs, Asian, African, Latin American, Migration, Economy

1. INTRODUCTION

Population growth, rapid urbanization, booming economy, and the increase in standards of living in a community have substantially enhanced the rate of municipal solid waste generation in developing countries (Minghua et al., 2009). Municipalities, generally responsible for management of waste in the cities, have the challenge to afford an efficient and effective system for the inhabitants. Nevertheless, there are problems beyond their abilities to cope with (Sujauddin et al., 2008) mostly because of the lack of financial resources, proper organization, complexity and system multi dimensionality (Burntley, 2007).

In recent years, a lot of research studies and papers have been done to specify useful and influential factors affecting waste management system in cities of developing countries. The elementary goals of solid waste management strategies are to address the aesthetic, land use, economic concerns, health and environmental aspects connected with the inappropriate disposal of waste (Henry et al., 2006; Nemerow, 2009; Wilson, 2007). These issues are current and ongoing concerns for individuals, corporations, municipalities and nations throughout the world (Nemerow, 2009), as well as the universal community at large scale (Wilson, 2007). In developing countries, waste is generated by burgeoning towns is overwhelming domestic authorities and the central government in a similar way (Tacoli, 2012; Yousif and Scott, 2007).

Besides, restricted resources result in the aggravation and perpetuation of inequalities already is being experienced by most of the vulnerable population (Konteh, 2009; UNDP, 2010). There are some models and analyses like system analyses – engineering models, analysis platforms, and assessment tools which are mainly targeting firmly defined engineered systems – and have been applied to assist agencies which are active in SWM in developed countries since 1960s (Chang et al., 2011). In addition, these system models have been utilized both as monitoring and optimizing the current SWM systems and as a decision support device for planning processes. However, there are some system analysis devices which have been utilized in developing countries (e.g. see Charnpratheep and Garner, 1997; Chang et al., 1997; Chang and Wang, 1996), majorities of these models were developed in United States and Canada (Chang et al., 2011).

While approximately all system analyses haven been failed at obtaining a wide system perspective of SWM, there is a need for holistic and integrating methods which address the interconnection of environmental, economic, technical and socio-cultural scopes, and this need is especially potent in developing countries particularly in low income ones, the complication of the SWM systems are frequently higher for a number of reasons, and the SWM segment is principally preoccupied with collection-removal services (Wilson, 2007).

Cities have undergone a quick urbanization in last 50 years. However, the number dwellers is expected to double between 1987 till 2015. Besides, approximately 90 percent of this rise will occur in developing world, where rates of growth exceed 3 percent annually, three times more than developed countries (UN-HABITAT 2003).

Furthermore, Urbanization in the developing countries implicates the expansion of current slum zones and the emergence of new ones. In the 1990's, the urban population in low income countries expanded by one third. According to the report published by UN-HABITAT in 2003, almost one billion people live in slums, or nearly one third of the world's city dwellers. If the current trends maintain, two billion people would be living in these areas by 2030 (UN-HABITAT 2003).

Future demand for waste collection is slum areas, therefore is presumably to put added strain on municipalities already unable to afford the service to their present habitants. Besides, increasing population levels intensifies the pressure on urban infrastructure in most of the cities already overburdened with the preparation of urban service. Also, many cities in developing countries lack the resources to get the need for services for instance water, solid waste management and sanitation.

Additionally, there are many cities in Africa and India which collect less than half of the waste that it is generated by their inhabitants. In a global scale, more than two third of human waste are dumping into the environment with little or no treatment, resulting in a degradation of urban environment in the form of water, land pollution and air which trigger risk to environment and human health (Suez Lyonnaise des Eaux 1998).

Besides, solid waste management in developing countries especially low income ones has received less attention from academics and politicians in comparison to other urban environmental challenges and problems like wastewater treatment and air pollution. Nonetheless, the inappropriate handling and disposal of solid waste builds severe problem such as; high morbidity and mortality rate in most of the cities.

Unfortunately, human activities create waste, and the manner these wastes are stored, handled, collected, transferred, transported and disposed of, absolutely pose serious risks to public health and environment. Where intensive human activities concentrate, such as in urban centers, the proper and secure solid waste management actions are of most importance to permit healthy living conditions for the inhabitants. This fact has been approved by the most of governments, however a lot of municipalities are struggling to afford the most elementary and basic services. Typically one to two thirds of solid waste produced is not collected (World Resources Institute, et al., 1996). As a consequence, the uncontrolled waste that is often mixed with animal and human excreta is dumped altogether in the avenues and in drains, hence contributing to flooding, breeding rodent vectors, insects and the spread of diseases (UNEP-IETC, 1996). Besides, most of the municipal solid waste in low income developing countries which is collected is dumped on land in an unmonitored and uncontrolled way.

Such insufficient waste disposal creates severe environmental problems which affect wellness of humans and animals and bring about serious economic and welfare losses. In addition, the environmental deterioration caused by insufficient disposal of waste can contaminate surface and ground water through seeping of the leachate, soil contamination through direct waste connection or leachate, air pollution by open burning of wastes, spreading of infectious diseases by various vectors like insects, birds and rodent, or uncontrolled release of methane gas by anaerobic decomposition of waste all over the cities. It is unfortunate that urban suffer mostly from the life-threatening conditions deriving from the inappropriate SWM (Kungskulniti, 1990; Lohani, 1984). Besides, as municipalities tend to allot their restricted financial resources to the wealthier zones of higher tax yields where inhabitants with more political power reside.

Usually, rich inhabitants use up part of their revenue to avoid direct exposure to the environmental problems next to their backyard, and problems are shifted away from their neighborhoods to somewhere else. Therefore, although environmental problems at the neighborhood level may recede in higher income zones, citywide and local environmental deterioration, due to a deficient SWM, remains or increases.

2. LITERATURE REVIEW

Past studies identified the people or stakeholders or organizations which may have an interest in sufficient waste management. The stakeholders are local and national government (Shekdar, 2009); municipalities; city corporations; non-governmental organizations (NGO's); households (Sujauddin et al., 2008); private contractor; Ministries of Health; Environment, Economy and Finance (Geng et al., 2009) and recycling companies (Tai et al., 2011).

Some researchers have recognized factors affecting the elements of the waste management systems. According to Sujauddin et al. (2008) waste generation is affected by size of the family, the level of education and monthly revenue. Family attitudes pertained to separation of waste are influenced by the active investment and support of the real estate company, community residential committees' involvement for public participation, and fee for collection service according to volume or weight of waste (Zhuang et al., 2008; Scheinberg, 2011).

Besides, gender, peer influence, land size, being a member of environmental association and household location illustrate the waste utilization and separation behavior of the household (Ekere et al., 2009). It has been related that the practices like collection, transfer and transport are influenced by inappropriate bin collection system, poor road planning, lack of data and information regarding the schedule of collection, inadequate infrastructure, weak route and number of vehicles for waste collection (Hazra and Goel, 2009; Moghadam et al., 2009; Henry et al., 2006). Furthermore, organizing the unofficial segments and boosting micro-enterprises were said by Sharholy et al (2008) as an impressive methods of expanding affordable waste collection services.

Lack of knowledge and science of treatment systems by local and national authorities is brought asone factor influencing the waste treatment (Chung and Lo, 2008). Tadesse et al 2008, analyzed the factors which affect household waste disposal decision making. The outcomes demonstrated which supply of waste facilities substantially affects the choice of waste disposal. Insufficient supply of the containers and longer haul to these containers increase the contingency of waste dumping in an open areas and roadsides related to the usage of communal containers.

Besides, inadequate fiscal resources restricting the security and safe disposal of waste in well-equipped and engineered landfills and lack of regulation is mentioned by Pokhrel and Viraraghavan (2005). In relation to the cost of disposal Scheinberg (2011), analyzed the data from solid waste management in the world's cities (Scheinberg et al., 2010), notes that there are indexes which high rates of recovery are connected with tipping prices at the disposal site. High disposal costs has the influence of more recovery of waste produced, which goes to the value chains or beneficial reuse of waste.

According to Gonzalez-Torre and Adenso-Diaz (2005) factors like social influences, altruistic and regulatory are some of the proofs why certain communities improve potent recycling programs. Besides, the authors also illustrated that people who continuously go to the bins to dispose of general refuse are more likely to participate in recycling programs at home, and in many cases, number of the citizens who participate in separation and collection programs at home increase as the distance to the recycling dustbins decrease. Minghua et al. (2009) mentioned that in order to rise recycling rate, the local authorities and national government have to motivate markets for recycled materials and enhancing professionalism in recycling companies. Furthermore, other factors stated by other researchers are fiscal support for recycling projects and plans and infrastructures (Nissim et al., 2005). Management of waste is also influenced by the aspects or enabling factors which facilitate the function of the system which are legal, institutional, socio-cultural, technical and environmental.

Literature proposes that technical factors affecting the system are pertain to the lack of technical skills amongst personnel within municipalities and government authorities (Hazra and Goel, 2009), insufficient infrastructure, poor roads and out of date vehicles, inadequate technologies and reliable information and data respectively offers which the factors influencing the environmental aspects of solid waste management in developing countries are the lack of evaluation of actual impacts and as well as environmental control systems (Moghadam et al., 2009; Mrayyan and Hamdi, 2006; Matete and Trois 2008; Asase et al. 2009).

Ekere et al. (2009) suggested that the involvement of the population in active environmental organizations is essential to have better systems. Municipal authorities have been unsuccessful to manage solid waste because of fiscal factors. The massive expenses required to afford the services, the absence of financial support, restricted resources, the unwillingness of the users to pay for service and lack of appropriate use of economic instruments have prevented the delivery of appropriate waste management services (Sharholy et al., 2007; Sujauddin et al., 2008).

sharholy et al. (2008) represented that involvement of the private segment is a factor which could develop the efficiency of the system. It is usually regarded that waste management is the solitary task and liability of local authorities, and that the public is not assumed to participate (Vidanaarachchi et al., 2006). The operational efficiency of solid waste management rely on the active contribution of both the municipal agency and the citizens. Hence, socio-cultural aspects stated by some researchers include people participating in decision making, community awareness and societal apathy for participating in solutions (Sharholy et al., 2008; Moghadam et al., 2009).

Besides, management deficits are frequently considered in the municipalities. Some scholars which have investigated the institutional factors which influence the system have come to the conclusion which domestic waste management authorities have a lack of leadership and occupational knowledge. Furthermore, it is concluded that the data existing is so marginal from the public domain (Chung and Lo, 2008). The very limited data and information is not complete or is scattered around different agencies connected. Therefore, it is extremely tough to achieve a vision into the intricate problem of municipal solid waste management (Seng et al., 2010).

In addition, waste workers are connected to low social status (Vidanaarachchi et al., 2006) situation which gives as a consequence of low passion amongst the solid waste employees. Politicians give low preference to solid waste compared to other activities belong to municipalities (Moghadam et al., 2009) with the final result of limited trained and skillful personnel in municipalities (Sharholy et al., 2008). Affirmative factors stated that develop the system are support from municipal authorities and strategic plans for waste management which permits monitoring and valuation of the system annually (Zurbrügg et al., 2005; Asase et al., 2009). Scholars have recorded how an insufficient ligitimate framework contributes affirmatively to the improvement of the integrated waste management system while the lack of satisfactory policies and poor legislations are adverse to it.

A typical waste management system is shown in figure 1 in a low-income countries that can be depicted by the elements:

- Generation and storage of household waste
- Reuse and recycling on household level including composting
- Primary waste collection and transport to transfer station or community bin
- The transfer station or community bin management
- Secondary collection and transport to the waste disposal site
- Disposal of waste in landfills

Recovering and recycling generally occur in all elements of the systems and it is broadly practiced by unofficial segment called waste pickers or by the solid waste management staff for the added revenue. Beside, recovered and recycled commodities then enter a chain of dealers, or processing prior to be sold to manufacturing enterprises.

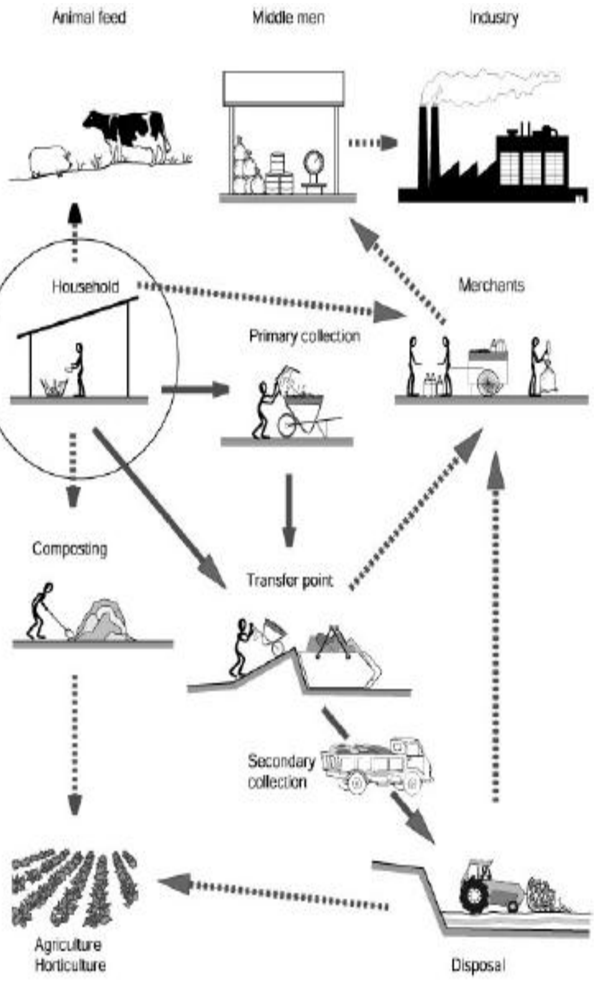

Figure 1: Typical elements of a solid waste management system in low- or middle-income countries (source: SANDEC/EAWAG)

3. SOLID WASTE MANAGEMENT IN DEVELOPING COUNTRIES

For a variety of reasons, poor waste management practices and its implications to public health remain acutely troublesome in many developing countries a century and a half after the European sanitary revolution, despite enhancing globalization (Konteh, 2009). In industrial countries, benefits of health from solid waste and sanitation systems are hugely taken for granted, and the concentration has switched from sanitation-related communicable disease to diseases of affluence such as cancer drug and alcohol abuse and cardiovascular disease and sustainability (Konteh, 2009; Langeweg et al., 2000; McGranahan, 2001).

Meanwhile, most of low income developing countries are presently influenced by the 'double burden' of the combined effects of the diseases of affluence and communicable disease (Boadi et al., 2005; Konteh, 2009). Wilson (2007, p. 204) demonstrates that "in some countries, simple survival is such a predominant concern, that waste management does not feature strongly on the list of public concerns". Furthermore, when SWM is on the public agendum in low income developing countries, it is driven by the same concerns same as industrialized countries, though it tends to be driven most potently by public health; the key preference is still getting the waste out from under backyard as it was for Europe and the United States till 1960s (Coffey and Coad, 2010; Memon, 2010; Rodic et al., 2010; Wilson, 2007).

Environmental protection is still relatively slight on the public and political schedule, although this is going to change (Wilson, 2007). Although the regulation and legislation is frequently in place requiring closure and phasing out of unregulated disposal, implementation tends to be poor (Wilson, 2007). The resources validity of waste is an essential motive in many low income developing countries nowadays; unofficial recycling affords a livelihood for the urban poor in many sections of the world (UN-HABITAT, 2010; Wilson, 2007). Besides, climate change is a significant motive worldwide – the clean improvement mechanism under the Kyoto protocol, in which improved countries can purchase 'carbon credits' from low income developing nations, can afford a vital source of revenue to motivate cities in developing countries to develop waste management systems (Wilson,2007).

Swift urbanization is occoring particularly in low income nations. Universally, in 1985, almost 41% of world population lived in urban zones, and by 2015 it is assumed to increase to 60% (Schertenleib, 1992). In addition, of this urban population 68% will be living in th towns of low income and lower middle income countries (figure 2).

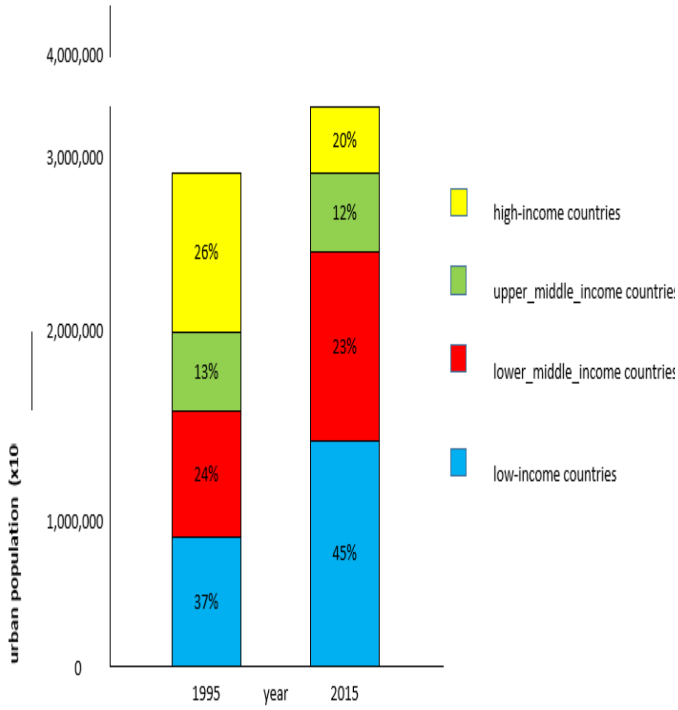

Figure 2: Global urban population categorized by of different economies (Schertenleib, 1992). Economies are divided according to 1996 GNP per capita: low income < 785 US$; low middle income 786-3115 US$; upper middle income 3116-9635 US$, and high income > 9636 US$ (http://www.worldbank.org/data/databytopic/class.htm)

There are many similarities which exist between the historical SWM improvement path of industrialized countries and the present path of developing countries. Beside, a lot of cities in lower income nations are experiencing same situations to those of the 19th century in high income countries; "deteriorating sanitary conditions, unprecedented levels of morbidity and mortality and high levels of urbanization which influenced mainly the working class population" (Konteh, 2009, p. 70).

In point of fact, increasing urbanization and socioeconomic disparities, insufficient provision of sanitary and environmental facilities, social deprivation and inequalities pertain to current SWM systems, and high levels of morbidity and mortality connected to insufficient sanitation, waste disposal and water supply provision were joint particularly in poorer urban neighborhoods in lower income nations (Konteh, 2009).

In spite of the obvious parallels, the context in which developing countries are proper is absolutely different from the historical contexts of developed ones. Besides, quick urbanization, ascending inequality and the tension for growth in economy; varying economic, cultural, socio-economic, and political outlooks; governance, institutional, and liability issues; and international influences have created locally specific, technical and non-technical challenges of broad complication (see figure 3).

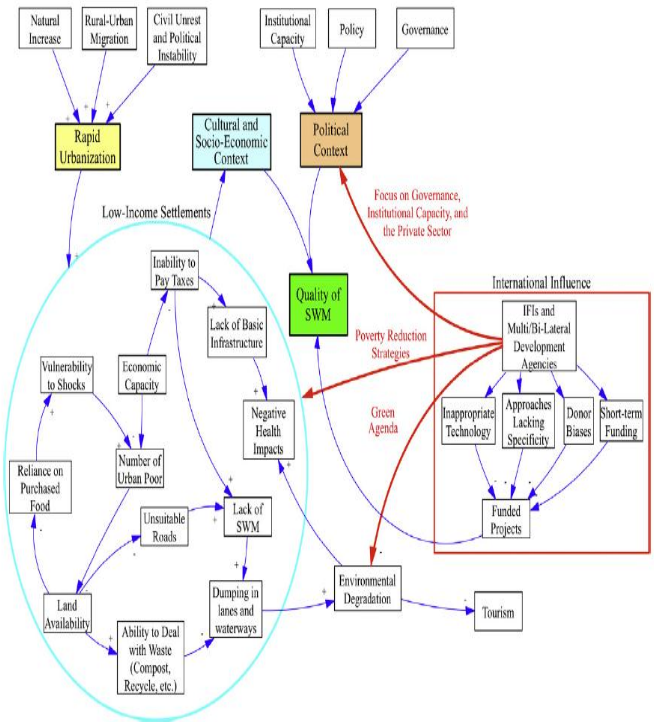

Fig. 3. Developing country SWM context.

4. DIFFERENCES BETWEEN DEVELOPED AND DEVELOPING COUNTRY CITIES THAT AFFECT MSWM

There are a deep differences exist between developed and developing countries in terms of revenue, consumption patterns, institutional capacity, capital available for urban investment and standard of living. Conventional solution generally do not count these differences, resulting in less than optimized outcomes. Table 1 give an outline of the waste production per capita as well as total waste production in countries of different revenue levels. Inhabitants of low income nations are willing to produce less garbage than inhabitants in wealthier zones. For example, China with billion-plus population, increasing economy and developing standard of living exceled the US as the world's largest producer of solid waste in 2005. If the present trends remain, India will also produce more total waste than US in 2025 (Medina 2008a, b).

Table 1: Waste generation per capita and total waste generation

	Waste generation rate (lbs./person/day)	Total waste generation (million tons/year)
Low-income countries	1.3	569
Middle-income countries	1.8	986
High-income countries	3.1	566

The below illustrate the major differences between developing and developed countries that pertain to the layout of MSWM solutions:

- Developed nations benefit a relative affluence of capital and enjoy high labor prices, while developing ones have a relative rarity of capital and affluence of inexperienced and cheap labor. It makes sense for the former to improvise waste management systems centralized in capital and that save in the prices of labor, however, it continuously does not make sense for the latter to pursue the similar approach.

- The physical specifications of towns in developing and developed nations vary noticeably. Besides, towns in the developing ones have the wide areas with substandard conditions – slums with narrow, hilly, and unpaved avenues. Most of immigrants cannot afford to buy land on which to construct their houses. As a consequence, some of them occupy empty land and become squatters. Most of the zones which lack refuse collection services are slum and squatter settlements. Besides, some domestic authorities reject to provide refuse collection to squatters due to not paying taxes. This refusal to afford waste collection has a detrimental influence on the urban milieu.

- An essential difference between developing and developed nations refers to the heterologous amount and specifications of waste produced. The waste produced tends to rise as revenue growths. Further, in addition to low-income societies generating less refuse, the combination of the waste also tends to be different. Waste produced in developing nations involves a huge percentage of organic substances, generally three times more than that of developed ones. Besides, the waste is also more intense and wet, because of the common consumption of fresh fruits and vegetables, as well as unpacked food. In developed nations residents consume more processed food and food packed in cans, bottle, plastics and jars containers than in developing counterparts. As a consequence, waste produced in the former contains high percentage of packaging materials than in that of latter.

- Multitude cities in the developing nations tolerate a dynamic unofficial segment which has evolved around waste, that provides revenue chances for recent migrants, unemployed, children, women, old people, and handicapped peoples. The most joint jobs are informal refuse collection and scavenging because of their significance.

5. CURRENT CHALLENGES

Collection, transportation, and disposal of MSW demonstrates a huge expense for developing nation cities: management of waste generally accounts 30 to 50 percent of municipal operational budgets. Despite these high expenditures, cities collect just 50 to 80 percent of the refuse produced. For instance, in India as a developing countries about 50 percent of refuse produced is collected. Disposal receives less attention: as much as 90 percent of the MSW collected in developing cities ends up in an open dumps (Cointreau 2008; Medina 1997a).

Besides, in areas which lack refuse collection generally low-income communities inhabitants tend either to dump their rubbish at the closest empty lots, public space, creek, or river, or simply burn it in their backyards. Uncollected waste can stack on the avenues and block drains when it rains, which might lead to flooding. Furthermore, waste can also be carried away by run-off water to lakes, seas and rivers, influencing those ecosystems. Another option is to end up waste in an open dumps, whether legal or illegal: the most popular disposal technique in the developing nation. Open dumping of solid waste produces different environmental and health hazards. The decommission of organic substances generates methane gas which can bring about fire and explosions, and contributes to global warming and climate change.

The biological and chemical processes which take place in an open dumps generate potent leachates, which contaminate surface and groundwater. Furthermore, fires periodically break out in open dumps, producing smoke and contributing to air pollution. For instance, in the Mexican city of Tampico, on the Gulf of Mexico coast, a fire burned for over six months at the local open dump. Fires at open dumps frequently begin spontaneously, leaded to the methane and heat produced by biological decomposition. Besides, dump managers in some cities intentionally periodically set fire at the dumps in order to decrease the tonnage of the waste, which permits higher waste to be disposed there and hence expands the life of the dumps.

In addition, human scavengers might also lead deliberate fires, since metals are easier to spot and recover amongst the ashes after the fire than amongst piles of mixed wastes. Food dregs and kitchen waste attract rats, flies, birds and other kinds of animals to the dumping sites. Animal feeding at the dump sites can transmit diseases to humans living in the adjacency. Biodegradation of organic substances could last decades, which might restrict the future usage of the land on which open dump sites are located.

6. CURRENT PERSPECTIVES: 'EMERGING' AND DEVELOPING NATIONS

6.1 Public health

There are possible hazards to environment and health from inappropriate handling of solid wastes. The direct health hazards concern majorly the workers in the field, who require to be protected, as far as possible, from contact with waste. Besides, there are also particular hazards in handling wastes from hospitals and health centers. For the general public, the major hazards to health are indirect and come from the breeding of disease vectors, elementary flies and rats.

Uncontrolled hazardous waste from industries with the mixture of municipal wastes produce possible hazards to human health. Traffic accidents can cause toxic spilled wastes. There is particular peril of concentration of heavy metals in the food supply and chain, a difficulty which demonstrates the relationship between liquid industrial effluents involving heavy metals and municipal solid wastes which are discharged to a drainage/sewerage system and or open dumping sites of municipal solid wastes and the wastes discharged thereby keeps a bad cycle containing there some other types of difficulties which are chemical poisoning through chemical inhalation. Besides, uncontrolled waste can obstruct the runoff from storm water resulting flooding. Low birth weight, cancer, congenital malformations, neurological disease, nausea and vomiting, mercury toxicity from eating fish with levels of mercury in the river, plastic found in shores ingested by birds, resulted in high algal population in lakes and rivers and seas, deteriorates water and soil quality.

6.2 Environment

The disintegration of waste into constituent chemical materials is a usual source of domestic environmental pollution. This problem is particularly severe in developing countries. There are very few landfills in those poor countries which meet environmental standards which is approved in developed countries requirements, and with finite budgets there are presumably to be few sites strictly evaluated prior to use in near future.

The problem and obstacle is compounded by the issues connected with quick urbanization. Besides, a main environmental concern is release of gas by decomposing garbage. Methane is a by-product of the anaerobic respiration of bacteria, and these bacteria prosper in landfills with huge amounts of moist. In addition, methane concentrations can reach up to 50 percent of the composition of landfill gas at the maximum anaerobic decomposition.

Furthermore, a secondary problem with these gases is their participation to the enhanced greenhouse gas effect, global warming and climate change. The leachate management differs all over the landfills of the developing nations. Leachate demonstrates a menace to domestic surface and ground water systems. The usage of compact clay deposits at the bottom of the waste pits, coupled with plastic sheeting-type liners to avoid infiltration into the surrounding soil, is usually regarded as the optimized strategy to involve excess liquid. In this way, waste is motivated to be evaporated rather than infiltrate.

7. CONCLUSION

All in all, waste management in the developing countries is unfavorable, unsatisfactory and unaccepted. The inappropriate management of solid waste illustrates a source of air, land, and water contamination, and demonstrates hazards to human health and the environment. Besides, despites remarkable expenditure, the situation will tend to degrade further because of the quick increase of cities which is presumably to take place over the next few decades. Globalization could rise the amount of waste which requires to be collected, transported, and disposed of, further straining cities in developing countries in Africa, Asia, and Latin America. Conventional solutions to waste management in the developing countries frequently depend on high technology, high cost, bureaucratic, and intensive alternatives. In addition, conventional solutions generally do not view the deep differences between rich and low-income and middle-income nations, resulting in less than optimized consequences. Furthermore, conventional solutions continuously contain the transfer of waste management technique from developing to developed nations. International improvement banks and mutual development agencies tend to favor this transfer technology. The experience on the usage of progressive technique in developing nations. However, has been hugely negative. Conventional waste management solutions generally neglect the possible contribution of the unofficial segment. Scavengers and informal reuse collectors give obvious economic and environmental profits to the community, and their activities should be developed and supported. Besides, a decentralized system would be more proper to the prevalent conditions in the developing countries. Successful usage of the low technology approaches, and the incorporation of unofficial refuse collectors and scavengers exist in different developing countries in Africa, Asia and Latin America. A decentralized system could assist to solve the apparently intractable problems and obstacles of the waste management in developing country cities in an socially favorable, economically reliable and environmentally sound manner.

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NFRs Model for Nuclear Power Plants

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Abstract: Requirements analysis phase plays a vital role in drawing the performance and characteristics of critical software systems. As the requirements were global, detailed and complementary as the system was successfully functioning, free of errors and flaws, and adapted to environment dynamicity. In critical systems, such as Nuclear Power Plants (NPPs), implementing software functional requirements (FRs) is not enough to ensure system safety. Non-functional requirements NFRs implementation beside FRs becomes crucial for ensuring such function. NFRs performs other functions that are essentials for system availability, reliability, and dependability. NFRs should be supportive, not precluding to FRs, and keep system complexity and cost as low as possible. To this end, this paper proposes a model for NFRs which have importance in nuclear field based on safety system classification, and graded approach which assign the quality attributes and constraints to a given system based on its importance to safety. This model helps in enhancing the system overall safety without increasing the system complexity and implementation cost without need.

Keywords: critical software system, requirements analysis, Nuclear Power Plants

1. INTRODUCTION

Safety critical software systems are considered as computer-based systems which of special concern in which failure of the system could lead to significant economic, physical damage to organizations or people injury. Such systems increasingly deployed in many critical systems such as, nuclear power plants, radiotherapy, aircrafts, and many medical devices. These systems rely on the use of safety critical software in controlling and monitoring critical devices. Success of such systems depending on the software requirements analysis. Requirements analysis is considered to be the most important phase in the software development lifecycle. It is widely recognized that, of all phases in software, it considered to be the most crucial task in software engineering. System requirements are divided into FRs, and NFRS. NFRs are often more critical than FRs in the determination of a system's perceived success or failure. According to Kotonya and Sommerville, the NFRs define the overall qualities of the resulting system that are often critical in nature, and sometimes functional requirements may need to be sacrificed to meet these non-functional constraints [1]. Ineffectively dealing with NFRs has led to a series of failures in software development [2], [3], as happened in well-known case of the London Ambulance System [4], where the deactivation of the system right after its deployment was strongly influenced by NFRs noncompliance. Literature [5], [6], [7] has been pointing out the difficulties of dealing with these requirements and showing that errors due to NFRs are the most expensive and difficult to correct.

Literature review also shows that, NFRs are often poorly understood and not considered adequately in software development due to the characteristics of NFRs, and difficulties. Also because there is no consensus about them [8]. Christoph Marhod et al. [9] show that there are many problems related to representing NFRs more than FRs. These problems causing the user non satisfaction and can expensive downtime or even complete failure of the system [10]. Requirements should be complete and express the entire need and purpose of the system and also should manage all conditions and constraints under which it applies [11].

The paper is organized as follows: section 2 introduces the related work. Section 3 represents the proposed NFRs model for NPPs. The last section concludes the discussion, and explores trends for future research work.

2. RELATED WORK

Critical software requirements analysis don't take into account the requirements imposed as a result of integrating the software with the environment and also other requirements related to the performance and the quality of the software, and the human interaction with the software. The following different kinds of requirements may be incomplete because different component parts of them are missing [12] such as data requirements, interface requirements, quality requirements, and constraints. In 1997, Gilb classified requirements to functions, qualities, costs and constraints [13]. The last three are regarded to NFRs. Qualities denote “How well the function will perform” and “any restrictions on the freedom of requirements or design” relates to the constraints. Gilb’s classification emerged due to the presence of unwanted or undesirable requirements or if it's false, unclear, and/or not possible to assess their satisfaction. IEEE Standard “IEEE Std-830-1993” [14] attempting to classify and specify NFRs. Glinz [15] classified NFRs as performance and quality related requirements that could be described using four facets: representation, satisfaction, kind, and role. In ISO 25010 [16] software quality model is defined, which composed of eight attributes. The attributes are reliability, performance, suitability, efficiency, security, portability, maintainability, and compatibility. According to the nature of the application domain, some of these NFRs are prioritized. NFRs such as security and reliability have more importance in safety critical systems than other systems [17]. Each system has a specific nature which requires suitable NFRs to be fulfilled according to its function and environment. The NFRs presented in [18] used in distributed control system in automation domain, the presented NFRs are reusability, modularity, interoperability, resource utilization, reliability, time behavior, analyzability, and installability. We are not aware of any other comprehensive approach to the NFRs classification. .Critical software NFRs should be not limited to the existing quality attributes of NFRs but should be extended to include other important NFRs specifically related to the system context, platform, and environment in which system is integrated. These NFRs represent the constraints that should be applied in the system according to its critical level. That the software should execute in a system context without contributing to unacceptable risk.

3. NFRs MODEL

This section provides a model for NFRs which have importance in NPPs based on safety system classification and graded approach which assigns the quality attributes and a set of suitable requirements to a given system based on its importance to safety. This model helps in enhancing the system overall safety without increasing in the system complexity and implementation cost without need. As the system environment is dynamic and has different modes of operation, consequently different requirements for each mode of operation are expected. As human or operator plays an important role in system operation and management, this requires a set of suitable requirements to improve and enhance interface with the system to avoid operator errors. Since the software is vulnerable to cyber-attacks which have severe consequences on system's safety, so security has a special concern and importance. Time is very important NFR, which the system should take action on time as required. Software input data, intermediate data (processed data), and output data can lead to system failure, and consequently lead to accident if they are not accurate, or incorrect. These NFRs may tend to be related to one or more FRs but they aren't FRs. These NFRs are essential for the system to be able to perform its functions safely.

The NFRs model for NPPs composites of two levels of NFRs, quality attributes level, and a set of suitable requirements for system application level as shown in Figure 1. The quality attributes level includes the essential set of NFRs, which are mandatory for such applications such as reliability, robustness, usability, maintainability, testability, and availability. The system application level, which includes NFRs that represent the required requirements and constraints according to the application nature in NPPs, and criticality of the system. These NFRs are data, modes of operation, system integration, security, and time. These NFRs should be considered in the design and implementation phases to ensure the safety of the system. Therefore, the designer of software should be considered and commensurate with the identified NFRs and related constraints.

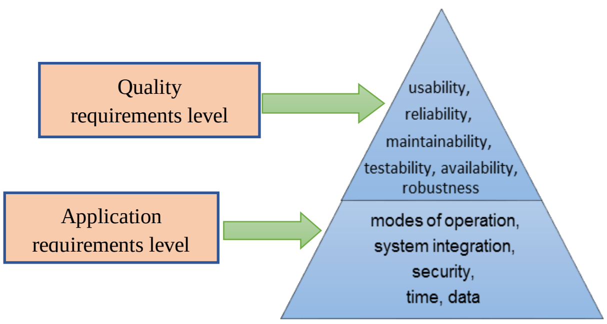

Figure 1 NFRs quality model

Each system in NPPs has a certain degree of criticality according to the importance of safety function to be performed, consequences of failure, period of time for which, the system will be called upon to perform a safety function and the calling frequency of the system to perform the required safety function. Systems criticality has a direct proportional relation with systems severity, which means high critical systems have high severity in case of failure. To design NFRs according to system importance to safety and its criticality, we have to present the systems classification schema in NPPs. Each system in NPPs performing a specific function and accordingly it is classified into one of three classes according to its function in the plant and severity in case of failure. Table 1 shows the relation between system criticality and system safety classification in NPPs.

Table 1 Npp systems safety classification

Safety class	System criticality (severity)
Class 1 (safety systems)	High
Class 2 (Safety related)	Medium
Class 3 (Non safety)	Low

The three safety classes are:

a) **Safety class 1**: contains safety systems which perform safety function such as reactor protection system, and whose failure would lead to consequences of high severity;
b) **Safety class 2**: contains safety related systems which perform safety related functions such as safety related monitoring and alarm system (fire alarm system, seismic information and control system). These systems do not impact safety directly, but may cause the NPP trips. In case of its failure would lead to consequences of medium severity;
c) **Safety class 3**: contains independent systems such as information processing and monitoring system for non-safety systems that do not impact NPP safety or trips (radiation monitoring system). The failure of these systems would lead to consequences of low severity.

For each safety class, there is a set of quality NFRs and a set of suitable application requirements which are designed according to system criticality. Table 2 illustrates the system classification in NPPs and associated suitable NFRs. Also the application constraints which have to be applied in the software design and implementation, and should be commensurate with the class of the target system, which can be key elements of meeting safety of the system.

In safety systems (safety class 1), based on the fact that these systems perform safety function such as RPS, which brings the reactor to a safe state when the safety setting value is reached by shutdown the reactor. All presented NFRs should be exist in this system. That the system should be: reliable to be trusted, available all the time because it performs safety function. The system also should be maintainable in case of failure occurred, testable at any time to check its operability, robust to have the ability to cope with errors during execution, and usable by the operator in easy way. While, safety critical system performs its function in reactor operation mode, it also continues to monitor the reactor variables after the reactor shutdown to inform the operator about the reactor state and values of the variables, so the requirement of modes of operation should be well addressed in the design, and implementation phases. While the safety critical system is an embedded system and operates in a dynamic environment, so the integration and compatibility between its components (software, computer system hardware, sensors, actuators, network, and operators) is very important and should be taken into consideration during the software failure analysis, design, implementation, and testing. As any digital system, critical software system is vulnerable to cyber-attacks, where such software system processes sensitive data and executes safety function, software security becomes an essential and crucial NFR. Software security is concerned about preventing unauthorized access to the running programs, and related data used since such access could result in a system malfunctioning due to intentional change to system settings and data values. For these reasons, software security should be addressed in the design, implementation, and test phases of the software. As this system performs a safety functions, so its safety decision should be taken in the required time, the time is very crucial constraint for successful safe operation. The critical software system function depends on input and output data, so the data constraints should be considered in different software development phases to ensure the safety and reliability of the system.

In safety, related systems such as a fire alarm control and information system, this system is safety related, and does not impact safety directly but may cause NPP trip. It has a medium importance to safety, so not all NFRs have to be considered in the software development lifecycle, such as modes of operation, and some of these NFRs may be considered partially i.e. not all constraints should be considered such as security, time, and data. While these systems operate in all operation states not specific for certain one, so NFR operation modes are not considered. Also, these systems do not deal with sensitive data and the probability to be attacked is medium, so security can be assured by any commercial security programs or security hardware. Not all constraints of time and data addressed in this system.

In non-safety systems, such as radiation information and monitoring system. These systems do not affect the NPP safety, and if these systems failed, there are alternative methods (detection devices) which can perform the same function. Not all NFRs addressed in the development of these systems such as availability, maintainability, robustness, modes of operation, system integration, and security, and some of them addressed partially such as time, and data. For example, security can be assured through physical security or even by system password because the system does not have sensitive data and not vulnerable to cyber-attacks. While radiation values can be monitored by another system, so the data requirements and constraints are important to be addressed, they are addressed partially. Time also is partially addressed to monitor the radiation value at the required time.

Table 2 NPP safety systems classification and associated NFRs

Safety class / NFRs	**Class 1**	**Class 2**	**Class 3**
Reliability	x	x	x
Availability	x	x	
Maintainability	x	x	
Robustness	x	x	
Testability	x	x	x
Usability	x	x	x
Modes of operation	x		
System integration	x	x	
Security	x	partially	
Data	x	partially	partially
Time	x	partially	partially

In this paper, we focus on discussing a set of suitable NFRs for safety class 1 systems in NPPs such as system integration, security, mode of operation, time, and data, which represent crucial requirements for class 1 systems in NPPs. These requirements are essential for these systems and should be fulfilled in the systems to improve the safety. Each one of these NFRs may be further decomposed into a set of constraints. These NFRs, and related constraints are explained in the following subsections.

3.1 System Integration

Each critical system embedded in critical environment includes software system which controls the operation of the system and the monitoring and supervision system which receive information from the critical software system and send control signal to the critical software. In such environment the integration and compatibility between the system components (software, computer system hardware, sensors, actuators, network, and operators) is very important and should be taken into consideration during the software failure analysis, design, implementation, and testing. The integration between these components of that system may lead to accidents if the design didn't consider the constraints related to this integration. That there is an affective relation between software and other components in the critical systems and should take into account the integration between software and the following components:

a) Hardware: through hardware interface module which can take inputs from sensors and give outputs to actuators, and other subsystems. During the development of software, the logical and physical characteristics of the interface between the critical software and the hardware components of the critical system should be identified. This may include the supported device types, the nature of the data and control interactions between the software and the hardware, and communication protocols to be used. For each sensor, the received values from the sensor in terms of data ranges, units, precision, error bounds, meaning, etc should described. For each actuator, describe the sent values to the actuator in terms of data ranges, units, precision, error bounds, meaning, etc. Also constraints and specifications for computer system hardware should be considered which includes physical devices that assist in the transfer of data, and perform logic operations such as busses, memory cards, and Central Processing Units (CPU). Based on the fact that the operating system has a crucial rule in the software operation. There are related constraints that should be considered such as process and stack management, exception handling, flow control, memory scheduling and allocation. These constraints have repercussion on the function safety.

b) Network: The network and infrastructure for each software system should be identified in terms of networking traffic, data transfer rates, error checking mechanism, input and output communication ports, interrupts, message format and throughput, exception handling and error recovery, and finally synchronization mechanisms.

c) Operator: through a human interface (human system interaction)

In safety critical systems, the main goal of the user interface is to allow operators to carry out activities such as monitor and supervise the system effectively and safely. The human system interaction has a great impact upon the human performance, which needs to be well designed. Many spectacular system failures are caused by human and user interface design errors. Many of accidents and events referenced to misinterpretation of system parameters consequently operators taking incorrect action, which leads to an accident as in Three Mile Island [19], the much publicized London Ambulance Service, and Therac-25 accidents, were attributable to poor operator Graphical User Interface (GUI) design as well as unreliable control software [20], [21]. High interface usability is aiming to make the operator more comfortable and reduce anxiety. The interface requirements should describe the logical characteristics of each interface between the critical software and operators. Establish criteria for monitoring the transmission of data between systems, including the identification of error conditions. This includes also sample screen images, any GUI standards or product family style guides that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, keyboard shortcuts, error message display standards, emergency windows, and so on. Define the software components for which an operator interface is needed. The system should interact with the user in an effective way that the system should notify the operators (send feedback) to operators that it takes a suitable time to complete an action. If the system cannot meet the required response time limits should keep users informed about what is going on for example if the required action takes more than one second, the system should notify the operator, and if it takes more than 10 seconds to allow the user to interact according to certain procedure. The following requirements and constraints are related to operator interfaces which should be considered:

1. The software interface should have the capability to handle a large amounts of information by means of scrolling, overlapping windows, and hierarchies of displays;
2. Error message should be visible, explicit, readable, precise, and constructive advice;
3. Human reaction and decision times (grace period) should be identified;
4. Menus techniques, colors, underlining and blinking on displays should be identified carefully and designed;
5. The alarms should be monitored easily and according to its criticality, by using color coding to distinguish the importance of alarms; the first priority of alarms is represented by red, the second by yellow, and the third by green;
6. Help menus, and emergency procedures menu should be clear, visible and not complicated;
7. Layout of controls and displays should be designed carefully;
8. The graphic module configuration should be identified and designed to be responsible for picture display parts, such as flow charts, trends, and alarms.

3.2 Operation Modes

Many of critical systems in NPPs have different modes such as startup mode, normal operation mode, maintenance mode, and shutdown mode. For each operation mode, there are many safety requirements. This type of NFRs should cover the different operating modes, and specify the protective action that should be taken in case of incidents. Each mode of operation determines the data to be processed, data to be monitored for operators, and certain allowed operator action. That some of operator actions can be locked. Critical software system should have the ability to perform self-management for procedures, and functions depending on different modes of critical system. Also should have the ability to switch between different procedures and functions and initiate other functions according to critical system modes of operation. These are not functional requirements in themselves, but constraints associated with each mode of operation such as:

a) Identify sufficient error logging, that in case of software failure or critical system failure, the critical software should have the ability to detect such failures.
b) Requirements regarding to modification request procedures according to different critical system operation mode;
c) The allowed and not allowed operations in each mode such as safety setting valued modification is forbidden in operation mode;
d) Time period required for moving from one mode to another;
e) Error handling in each mode should be identified;
f) Alarm or action triggers for each mode should be identified;
g) Establish system health check procedures.

3.3 Data

The NF data requirement should be identified based on a set of constraints as shown in Figure 5. These constraints are very important for critical software systems in NPPs. According to the input data, there is a decision will be taken, this decision may be related to a safety function such as shutdown the nuclear reactor. Also, the data have importance in the calculations which are performed in the reactor. So, the input data should be accurate, in range, arrive in the required time, and represented correctly. In addition to the retention of the data which should be identified. These constraints should be identified and checked during the software design, and operation. The representation of the data is important also for the operator to easily monitor the plant and take the appropriate action according to the data represented.

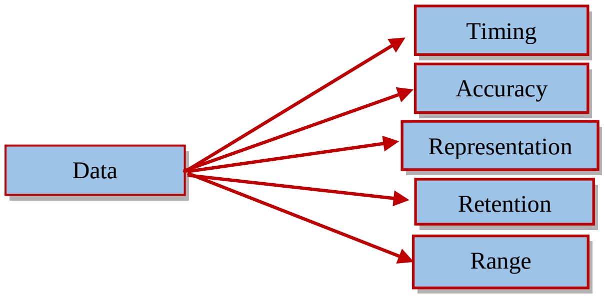

Figure 5 Data constraints

The constraints of data attribute are illustrated as follows:

a) **Timing**: the input data should be received on time not after or before the required time;
b) **Accuracy**: the accepted degree of data accuracy should be identified. The data to be correct, its values should be in the right value and represented in a consistent and unambiguous form;
c) **Representation**: the convenient way data representation for operator usage should be identified to make an easy and fast evaluation for system status;
d) **Retention**: define the length of time data needs to be retained after it is no longer considered active. Define whether the data are required to be available real time or can be stored in an archive;
e) **Range**: the input data range with both limits, high and low should be identified and checked.

3.4 Time

The time as NFR has a vital role in critical real time software systems for NPPs. These systems should response to any designed or undesigned action within a certain period of time. There are constraints of time that should be considered in the design and implementation phase to guarantee that the system response within the specified time as shown in Figure 6 such as response time, startup time, processing time, and hardware failure detection time. These constraints should be continuously checked during the runtime of the software to update the operator in case of any degradation occurred.

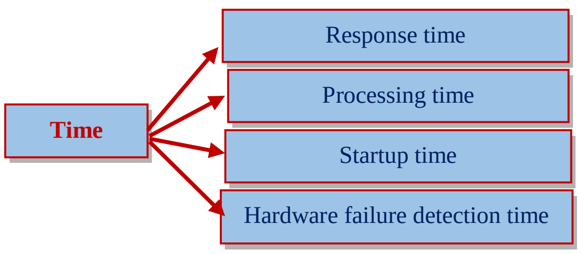

Figure 6 Time requirements and constraints

3.5 Security

With the growing trend in using safety critical software as an embedded system in many critical applications in NPPs, where such software systems contain sensitive data and perform a safety function, software security becomes an essential, and crucial NFR. Software security is concerned about preventing unauthorized access to the running programs, and related data used for such access could result in a system malfunctioning due to intentional interference. The consequence of such interference could be an accident or system fail to perform its intended protective action. So Software security aims to maintain and preserve confidentiality, integrity, and availability as shown in Figure 7. The result or impact of the attack might include:

a) Denial of service/loss of function: blocking the operator's ability to observe and/or respond to changing system conditions, speeding the system down and may affect the system availability.
b) Interception: intercepting and modifying data streams passed between systems or corrupting the data and this may affect the system behavior and consequently its safety.
c) Unobserved system monitoring and data collection: unauthorized file access and data recording, including the message (information) intercept.
d) Operator spoofing leading to incorrect action: injecting anomalous readings into a control panel, causing the operator to take incorrect action.
e) Direct manipulation of computer systems: giving the attacker independent control over processes and machinery.

Figure 7 security requirements

Based on the fact that attacks may come in each phase of software as a result of drawbacks and shortage in these phases such as design errors, and source code bugs. So critical software system should be developed in secured environment and each phase of software development should be designed, implemented, and executed under suitable security measures for each phase. Security for critical software should provide in terms of secure models, secure coding practices, and secure development procedures. Also security should be assured during deployment and maintenance phases. Exploitable faults and other weaknesses are eliminated to the greatest extent possible by efficient design, and well-intentioned engineers. The security design should be based upon certain threats/threat types, identified security goals, security requirements and security functions as shown in Figure 8. Assurance for such objectives are achieved by implementing the identified security functions. Security controls such as auditing, reviewing, and testing should not be limited to the requirements, design, implementation, and test phases of the software lifecycle. It is important to continue performing code reviews, auditing and security tests, during deployment, operations, and in case of updating to ensure that updates do not add security weaknesses or malicious logic to the software.

Figure 8 Security design flow

4. CONCLUSION

This paper established the base for designing and implementing NFRs applied for NPPs critical software systems and presented a new model for NFRs. More NFRs means more quality, but on the side leads to more coast and more systems complexity, based on this fact, selecting and implementing NFRs for a given system should be decided by its the importance to the system and how much the selected NFRs will improve the system's quality. For this reason, in this paper designing and implementing NFRs for NPPs were engineered by using the graded approach as a well-known approach in the nuclear field. Different NPPs systems are classified into three classes, safety, safety related, and non-safety according to severity of consequences if one of an NPP systems failed to perform its required function. The new NFRs model based on a graded approach to assign NFRs for each class and justify the required constraints associated with each attribute specially for safety class. This model is characterized by correlating between the system function importance to safety and supportive NFRs to be designed and implemented in the system to improve the system performance quality without more unrequired excessive complexity.

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Better Signal Processing Algorithms

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Abstract: The following paper comprises of better signal processing algorithms
Keywords: signal processing

1. INTRODUCTION

The following algorithms were found to be working in an experimental environment with better efficiency.

1.1 Achieving efficiency in computations

1) Please find attached new algorithms proposed for all function mappings and matrix inversions. f(x) is compu acclaimed inversefft(f(fft(x))). Matrix inversions tailoring elements belongs to least important values in gaussian distribution.

2) In quantization of signals, practically it is advisable to take errored signal of the lesser valued than the value as constructed. The reason being intensity reduction is naturally acclaimed.Intensity increase amounts to snooping or manipulations.

3) In specifications where output signal amplitude reaches beyond permissible limits, it is not going to destruct the system. This time taken is the scale to reac14Infinity.

4) In signal data diversification where we do diversification for lesser noise in data, the unaltered value happens to be 0 if strong zero or 1 if strong one depending on vlsi fabrication. This has very little noise in the system.

5) In a function provision should be made to introduce changes in newer implementation of functions which are exponentially going to bring down computation time.

6) Mathematical analysis of imaginary component implication: No calculation computed when in imaginary value. Calculated value also informed from imaginary component after the time lapse.

7) Kernel SVM implementation Initial clustering assigning in SVM classification should happen with the wrong classification assignment to achieve better classification.

8) If two points are connected indirectly if there is a possibility of an energy transfer between these two points there is going to be a direct energy transfer between these two points.

9) Sampling frequency of human ear is 4000 Hz. The value of signal at a distance of 1/4000 Hz from a signal 't' seconds from origin is highly correlated and correlated at its maximum value at this point.

10) In signal processing if the input is predicted at the output it is going to increase the speed of operation of the processor. The input reaching the output should be with minimum noise s maximum length of transmission line is necessitated

11) There is always an uncertainty from what sumed and what actually is.

12) The transmission line waves are assumed to carry current with minimal frequency. This current carrying waves produce magnetic fields surrounding the transmission line waveguides. The transmission line waveguides are null below a threshold and never attenuate beyond this cut-off. On analyzing this attenuation in terms of magnetic field generated we see that the magnetic field produced changes direction at this cut-off frequency threshold.

13) Analysis of Image forgery detection mentioned in the reference the algorithm is extended to speech forgery detection. Image and speech are considered identical with a different base and cardinality of base. Image is considered to be in two dimensional basis. Speech is considered in a different three dimensional base. All functions in the previous work are mapped and approximated into 3 dimensional base.

14) The following model is proposed to overcome shortcomings of the work proposed in Neural network modelling of color array filter for image forgery detection using kernel method. Model the shape, its dimensions, color and few more attributes (which can be learnt as required) and find a relation between these features using different neural networks and other classification methods like Support Vector Machines When the wavelength of light is comparable to the dimensions of an object - the object cannot radiate that color.

When the wavelength of a light illuminated matches with that of the object being considered (1D case is taken for simplicity), this light (with that frequency) cannot illuminate that object and so that object cannot hold that color. When this is extended to higher values for the length (i.e in centimeters for example), the object cannot illuminate that color.For red, the mid point of the wavelength band is 700 nano meters and so a stick of length 700 cm cannot radiate this red color being illuminated. This relation becomes complicated for 3D objects and still more complicated when they are of different shapes.

15) The random initialization of supervised learning methods is to be done in the opposite way of what actually the classification is. This is done to make sure that learning happens and we achieve a better classification rate.

16) All the intensity levels in the given image are quantised into 4 different linear quantisation levels. All possible shapes which might appear in the image data base are classified into 12 plausible shape data base. The match happens when (shape data base, quantisation level) pair matches exactly. Total number of possible output points is (12! + 4!)/(sum of n terms till 12 + sum of n terms till 4) which equals 130636800.

17) All the intensity levels in the given image are quantised into 4 different linear quantisation levels. All possible shapes which might appear in the image data base are classified into 12 plausible shape data base. The match happens when (shape data base, quantisation level) pair matches exactly. Total number of possible output points is (12! + 4!)/(sum of n terms till 12 + sum of n terms till 4) which equals 130636800

Equations:

1)

1. Assume the transformation a->a'->b'->b
2. Initial function map achieved f(a) = b;
3. A value measured can have errors due to computational limits.
4. To avoid errors from getting transmigrated to output we invent noiseless functions in the above manner.
5. Experimentally the input image matrix values extracted taken as 'a' is mapped using neural network as a nonlinear transformation to the weight vectors. These weight vectors are considered as a'. They are then mapped to output values which is the transformation function which are then dimensionally reduced to classification values as kernel LDA.

The transformation in the considered work (1) can be looked at in two different ways.

Take the weights of the first phase of transformation and use them for dimensional reduction. This leads to lot of redundancy as seen in LDA where only one variable remains out of 34 variables. Second. Take the weights of transformation from the full neural network where we see more elements as output of this function. As seen in the output there are lot of redundancies in calculation in this case. More the redundancy more the error incurred from the calculations.

2)

1. The covariance matrix computed is taken for analysis. The multiplication factor is always lesser than 1. This validates the second statement.
2. we infer if the multiplicative factor is more than one there is a manipulative code.
3. The 1x34 variable containing matrix is quantised into 1x1 matrix. The magnitude of the resultant vector is smaller than that of the input vector of size 1x34. This is evident from the noise to be attributed.

3)

1. The signal transformation in logsig function implies to any value of input signal in terms of time.

4)

1. In the discriminant analysis the most significant vector is unaltered. This is evident from graph theory.

2. ACKNOWLEDGMENTS

Our thanks to the experts who have contributed towards development of the template.

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Image Forgery Detection Based on Shape of Eye Ball

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Abstract: Use a learning method like back propagation neural network svm and kernels to study the relationship between real axis samples and complex numbers. Since the relation between real and imaginary axis is deterministic the neural network is expected to reach the same weight matrices at the end of training.

Keywords: Image Forgering

1. INTRODUCTION

Changing the order of input elements vs the output elements changes the interpolation function and is a novel way of looking at neural networks.

1. Use a learning method like back propogation neural network svm and kernels to study the relationship between real axis samples and complex numbers. Since the relation between real and imaginary axis is deterministic the neural network is expected to reach the same weight matrices at the end of training.

The shape of eye ball is spherical. So many forged images look like real world objects. Image database is taken for spherical shaped objects and a neural network architecture as arrived at as in reference 1 is formed.

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Investigating ATM Frauds In Sunyani Municipality: Customer's Perspective

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Abstract: Customers in the banking industries in Ghana have seen a tremendous change in banking activities and deliveries, since the introduction of electronic banking systems. This research seeks to examine the knowledge of Automatic Teller Machine (ATM) card and its service users, educate the general public (**Customers**) on frauds associated with ATM and how to protect themselves against these fraud. The research also outline strategies and methods that customers and custodians of the ATM can adopt for prevention of some ATM frauds. Questionnaires and semi structure interviews were used as a methodology to collect data. A non-probability sampling technique was adopted by this research to provide a range of alternative techniques based on researchers' subjective judgment. We employed Microsoft Excel and SPSS for analysis and interpretation of the collected data. ATM users of selected banks in the Sunyani Municipality were defined as population of interest. A sample size of 500 ATM users from different banks were used as a case study. The findings showed that, only 57 out of 438 representing (17.76%) of respondents that uses ATM and it service have a little knowledge about frauds associated with ATM in the municipality.

Keywords: ATM-Frauds; Skimming-Attacks; PIN-Cracking; Phishing-Attacks; Shoulder-Surfing; Cash Trapping; ATM Malware; Sunyani-Ghana

1. INTRODUCTION

The advancement in technology has made banking moved from the cash economy to cheque economy, and now advanced to plastic card economy (Twum, et al., 2016). Lately, the debit card has become the wildest emergent medium of payment around the globe (Mahony, et al., 2001). Automatic Teller Machine ATM is a cash-machine mounted by financial institutions and banks, which enables their customers and clients to perform banking services, like cash deposit, cash withdrawal, and request of mini statement, balance query and money transfer from one account to the other and also mobile money transactions for some ATMs (Twum, et al., 2016). The first Automatic Teller Machine introduced for public use was by Barclays bank in 1967, in London, Hendson branch, which had the capability of dispensing a constant amount, when its users inserts a special coded card. Since then, ATM has developed to be small in size, easier to use and faster in communication (Das & Jhunu, 2011). The introduction of the ATM into the banking industry has made available a 24 x 7 hours cash withdrawals and deposits to bank customers and clients. The ATM since its implementation has suffered numerous fraud attack and still continue to suffer these attacks.

2. ATM FRAUDS CASES

Theft in ATM machines has increased widely. The current authentication mechanism (Personal Identification Number) of the ATM machines are not safe in order to provide proper security for cash and users (Hirakawa, 2013) and (Varalakshmi, 2015). According to the European ATM Security (EAST), a total of 1,459 ATMs were raided all over Europe in the first half of 2009, totalling 4.5 crimes or attacks annually for every 1,000 ATMs. And also 26 ATMs were robbed starting November 2007 to November 2008, totalling 18 crimes per thousand ATMs out of 1,471 ATMs in Lithuania (Dare, 2011). A report by European ATM Security Team (EAST) shows that ATM frauds by skimming attack in the first half of 2009 has risen to 24% more by the first half of 2010 (Gunn, 2010; Twum, et al., 2016). A report by (Bianchi, et al., 2010) stated that, Germany in 2009 recorded a total of two thousand fifty-eight (2,058) cases of ATM crimes, where over 100,000 ATM users were affected, which is 20% higher than ATM fraud cases in 2008 and the trend continues in 2010. In 2013 Australia recorded growth from 43.6 cents in 2012 to 48.7 cents for every $ 1,000 spent; this is against an increase of 4% to $624 billion on the total amount spent by Australians. While card not present fraud increased from 45% in 2008 to 72% in 2013 in Australia. At the same time, UK saw an increase in card fraud rates from 71 pence to 74 pence in every £1,000 spent. Card-not-present fraud on UK cards increased from £246.0 million to £301.1 million (APCA, 2014). Computer frauds resulting from cybercrimes and theft have become very alarming with the introduction of numerous ATM and real time online E-banking and commerce (Awuge, et al., 2012). The Ghana Commercial Bank in 2013 was hit with an ATM theft amounting to GH¢3 million (Obour, 2013). In 2015 another ATM fraud hit Ghana, two Bulgarians withdrawn money from ATMs of some banks in Ghana by cloning ATM cards of customers (Acquah, 2015). In 2016 Six Nigerians made away with millions of Cedis from VISA ATM machines in the country from over 150 ATM, which was described by bankers and security personnel as one of the biggest ATM scams in the history of Ghana (Citibusinessnews, 2016).

This uprising of ATM frauds among the Ghanaian populates, calls for more studies on ATM users alertness and knowledge of frauds associated ATM, so as to educate ATM users and ATM operators with the view to improving ATM service quality and customer security.

2.1 Common Types of ATM Frauds

There are numerous password attacks on ATM, but in this section of this research few are described, so that the user of the ATM can understand and beware of unauthorized access or password attacks. Basically, there are three main attacks that ATMs are subject to, namely;

1. Physical attack: Brute force attack, thus applying mechanical force on the ATM machine, with the intention of getting access to cash within the safe.
2. ATM Fraud: Bank card information theft, using an unauthorized means to get access to the customer's information stored on the ATM card.
3. Software and network attack: Theft of sensitive information or controlling ATM operations from a remote distance or automatically.

These basic three ATM attacks can be split up into;

- ✓ PIN Cracking
- ✓ Skimming Attacks
- ✓ Shoulder Surfing
- ✓ Phishing Attacks
- ✓ Card Trapping
- ✓ Cash Trapping
- ✓ ATM Malware

2.1.1 Skimming Attacks

The skimming attack is the most common attack in ATM transaction. In this attack, lawbreakers take advantage of technology to make fake ATM cards by using a skimmer (a card swipe device that reads the information on ATM card). This device looks like a handheld credit card scanner and is often clipped in close proximity to or over the top of an ATM's factory installed card reader (Mandal, 2013). When a skimmer is removed from the ATM, it allows the download of personal data belonging to everyone or customers who used the ATM whiles the skimmer was in place. 200 ATM card information can be stored on single skimmer (Krebs, 2010). According to Rick Doten, the annual losses from ATM totalled about $1 billion in 2008, or approximately about $350,000 every day from the U.S. Secret Service estimation, Card skimming accounts for more than 80 percent of ATM fraud (Krebs, 2010). In December 2009 this particular skimmer was attached to the front end of Citibank ATM in Woodland Hills, Calif. (Krebs, 2010)

2.1.2 Card Trapping

This involves, placing a device directly over or into the ATM card reader slot, which physically captures the ATM cards when inserted into it. When the user leaves the ATM without his or her card, the card is retrieved by the thieves or hackers.

Figure 1 ATM Skimming Device. (Krebs, 2010)

With this attack one ATM card is lost per attack. At every captured card, the hackers or criminals have to withdraw the whole device. Lately a newly card trapping device capable of trapping users' cards for a long time and enhance with the ability of removing trapping cards without removing the trap device have been introduced by ATM fraudsters. The common variant is well-known as the Lebanese Loop (Mohammed, 2011).

Figure. 2 ATM Card Trapping. Source (Agarwal, 2010)

2.1.3 Phishing Attacks

This is an attack on the web, where scammers aim at luring ATM users to provide their card information and PIN details of their bank card. In a typical attack, an attacker uses an email pretending as a bank and claims that user's account information is inadequate, or users' needs to update their account information to prevent the account from being closed. The user is asked to click on a link and follow the directions provided. The link however is fraudulent and leads the system user to a different website that the attacker has set up which resembles the website of the user's bank.

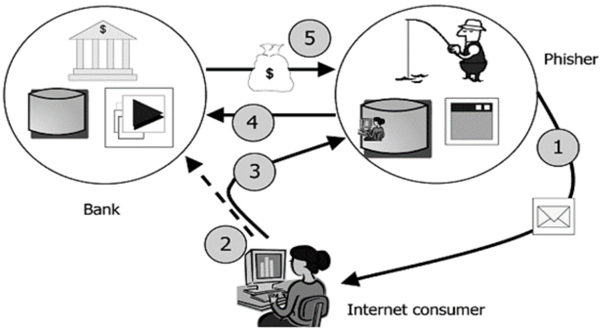

Figure. 3 How Phishing Attack Works. Source: cccindy.com

2.1.4 ATM Malware

This ATM attack requires an insider, such as an ATM technician who has a key to the machine, to install the malware on the ATM operating system or software. Once that has been done, the attackers could insert a control card into the machine's card reader to trigger the malware, this gives the hacker or attacker an access to control the ATM through a custom interface and the ATM's keypad (Mandal, 2013).

2.1.5 Shoulder Surfing

Shoulder surfing Attack involves direct observation of ATM's user details by the attacker, such as looking over the shoulder of the card user, to get his/her information. This attack method is very effective in getting ones information in a congested environment, because it's quite easy to stand next to someone or stretch your neck and watch as She/he fill out a form, entering a PIN number at an ATM machine (Mandal, 2013). Shoulder surfing can also be done from a remote distance with the aid of eyeglasses or other vision enhancing devices. To prevent or minimize shoulder surfing attack, it's advisable to shield the keypad with your body when using an ATM.

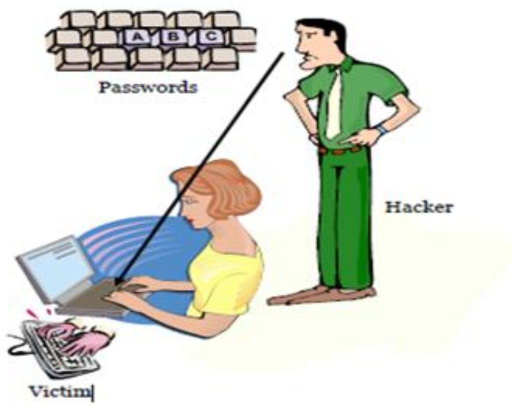

Figure. 4 Shoulder Surfing. (Source: www.crazylearner.org)

2.1.6 Cash Trapping

With this attack, the attackers or criminals insert a false withdrawal close up slot. The false slot causes the cash to get stuck within it, whiles a customer is performing a withdrawal transaction on the ATM. The customer will leave the ATM premises, thinking the machine is out of order or may go inside the banking hall or premises to report the incident. The attackers then return to retrieve the money or notes from the ATM.

Figure. 5 Cash is trapped by the false withdrawal shutter. Source: (Agarwal, 2010)

2.1.6.1 ATM Cash Trapping Cases

On 5th March 2011, the London city police arrested two Romanian of age 23 and 25 within a flat in Harrow. These men were found in possession of cash traps, which have been used to trap customer transactions on various ATM's. (BBC , 2011). On Thursday, 31 March 2011 two men, ages 23 and 21 were arrested for allegedly trying to steal cash from bank customers by tampering with an ATM in Chingford, using a small plastic strip which causes cash ejected from the ATM to become stuck (Daniel, 2011).

2.1.7 Eavesdropping

Eavesdropping is the process of secretly listening to the private conversation of others without their consent. Spying on an ATM user and knowing his or her PIN and then obtain his or her card by any faulty means (Mohsin, et al., 2015).

Basic eavesdropping techniques are;

- ✓ Viewing victims monitor using binocular through an open window.
- ✓ Capturing people's information by installing small cameras whiles the information is being read.

2.1.7.1 ATM Eavesdropping Cases

Global ATM manufacturer NCR Corporation issued an alert about a card reader eavesdropping attacks, which were first identified in Europe in 2014 and are now spreading, potentially posing a risk in the U.S. (Kitten, 2015).

2.2 The Study Area

Sunyani is the capital of the Brong-Ahafo Region of Ghana. Sunyani municipality is one out of the twenty-seven (27) aadministrative districts in the Brong-Ahafo region. It is located between Latitudes 70 20' N and 70 05'N and Longitudes 20 30'W and 2010'W. Fig. 1 shows the location of Sunyani Municipality on the Ghana Map (Peprah & Ayidana, 2014).

Figure 6. Map of Ghana Showing the Location of Sunyani

3. MATERIALS AND METHODS

The date was obtained mainly from clients of Barclays, GCB, NIB, Ecobank and Zenith banks in the Sunyani Metropolis. For a good research outcome, a total population sample of five hundred users of ATM were orally interviewed and also given structured questionnaire to answer, (120 Barclays bank customer, 100 GCB customers, 105 Zenith bank customers, 50 NIB bank customers and 125 Ecobank customers). The respondents were categories into their respective educational background by using stratified sampling method, after which simple random techniques was employed to draw proportionate sample from the stratum. Out of the five hundred questionnaires distributed, 438 responded (Response Rate 87.6%). The questions were categorised into two sections. The demographic information of the respondents is acquired in the first section whiles the second section collects knowledge of respondents on ATM associated frauds.

4. RESULTS AND DISCUSSION

Figure 7, shows the percentage age distributions of the 438 ATM users surveyed.

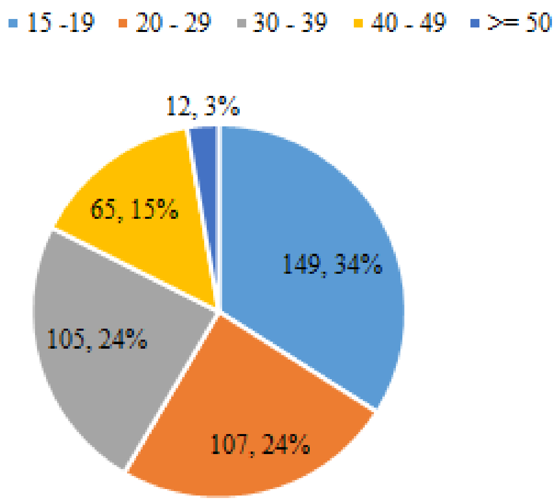

Figure 7 Age distributions of surveyed subjects

The Breakdown presented in Figure 8 shows that 19 (4.11%) of the respondents have been using ATM since its introduction in Ghana while 29 (6.62%), 38 (8.68%), 111 (25.34%), 102 (23.29%), 63 (14.38%), 54 (12.33%), 23 (5.25%) of the subjects have 7, 6, 5, 4, 3, 2 and 1 year ATM experiences respectively.

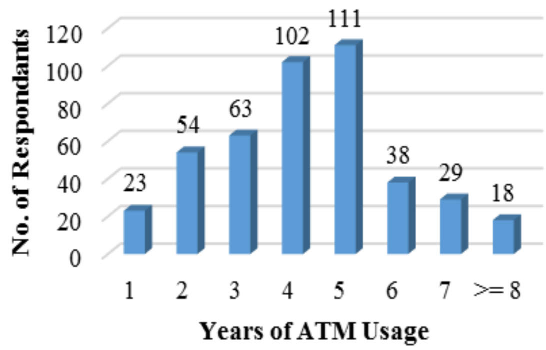

Figure 8 Bar chart of number of respondents' years of ATM usage

Customers' reasons for using ATM

The response obtained shows that, there are various reasons, which included conveniences, speed, reliability and security. The responses of ATM users are shown in figure 9

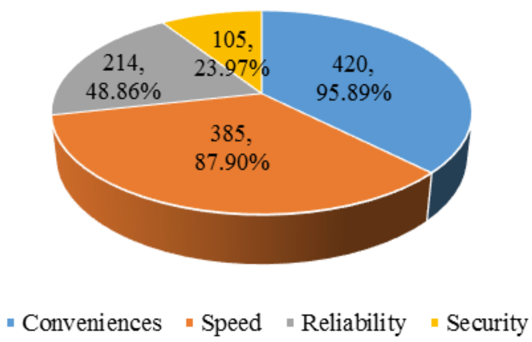

Figure 9 Customers' reasons for using ATM

Speed: respondents expressed that, they spend less time with ATM transactions as compared to the human teller. The pie chart in figure 8, shows that 385 respondents representing 87.90% of the total respondents use ATM services due to the speed involved in accessing cash and other transaction from the ATM.

Convenience: customers dodging long queues in the banking halls. In the analysis of the data gathered, where customers were given multiple choices to select from, 95.89% which represents 420 out of the 438 respondents answered that, they using ATM was influenced by its convenience.

Reliability: this is associated with the 24 x 7 hours of ATM service. 48.86% of the respondents, gave reliability as the results of them using ATM services.

Security: this talks about how customers feel secured in engaging in ATM transactions. Even though 438 of respondents uses ATM service only 105 (23.97%) out of 438 express that they are stratified with the security provided in ATM.

Customers Knowledge on ATM frauds

Respondent were ask if they have heard about ATM frauds, and 73.29% representing 321 out of 438 responded yes whiles 3.38% representing 17 responded no. Figure 10 shows the outcome of the data analysis.

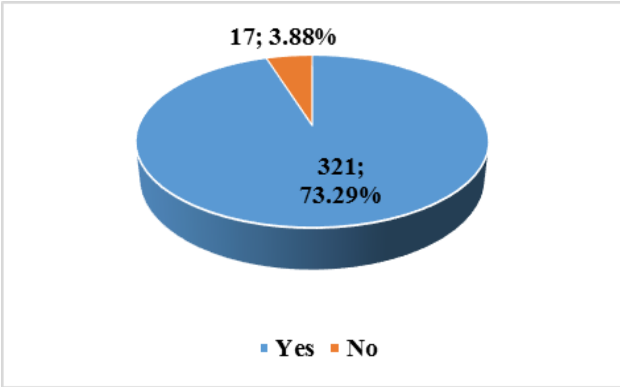

Figure 10 Respondents' Knowledge on what ATM fraud is

A futher question was posed to respondents to whom one way or the other have have what ATM frauds is, to examine the knowledged on the various type of ATM frauds.

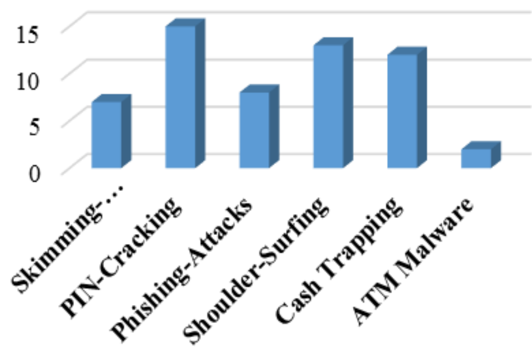

Table 1 Respondents' Knowledge on ATM Frauds Types

Skimming-Attacks	7
PIN-Cracking	15
Phishing-Attacks	8
Shoulder-Surfing	13
Cash Trapping	12
ATM Malware	2
Total	57

From the data analysis shown in table 1, a total of 57 respondents out of 321 respondents that new ATM fraud had knowledge of the various types of ATM frauds, representing 17.76%. This proves that a majority of ATM users have no knowledge on the types of frauds associated with ATM and its services. Shoulder-Surfing which is the common ATM fraud reordered 13 out of 75 representing.

4.1 Protections Against ATM frauds

The low responses of customers' knowledge on ATM frauds calls for education on how to prevent or secure ATM users from its associated frauds.

4.1.1 How to Avoid Credit Card Skimmers

- ✓ Be vigilant (Keep your eyes open). When you visit any ATM and it looks a little unfastened, or sticky tape remains or you suspect scratches, be wise and report to the bank or find another one. Thieves normally attach fake or imitated fronts to ATM with tape. Also try to pick around with your fingernail at the keypad to make sure that no other keypad on top of it.

- ✓ Never ever assumed that all ATM are the same or equal. Be on guard when your find yourself in another current or tourist area, because these are prime target for ATM thief. Make use the ATM within the banking hall, as opposed to one that is just outside (Heet, 2011).

- ✓ Never leave your card in an ATM, even when you are to inform the bank of a problem. Alternatively, make a call to the bank that you at the ATM and you have a problem with your card or alert the security man on duty. This will preserve your account safe and identity protected until you get help (Keith, 2013).

- ✓ Be in the habit of using the same ATM machine for your transactions, and become familiar with it and be able to identify or recognize changes to the machine (Keith, 2013).

4.1.2 Shoulder-Surfing attacks

- ✓ Stand very close to the cash machine. Always use free hand and body to shield the keypad and your body to present anyone eagle-eyeing your PIN and personal information.

- ✓ Always asked for help from bank staff when you performing transactions on ATM.

4.1.3 Protection against Phishing-Attacks

- ✓ Don't you ever follow any link in an email pretending to be sent by your bank, rather visit your bank website directly and log into your accounts to see if an update notice has been sent to you. These emails are almost always a phishing scam (Keith, 2013).

- ✓ Be extra care when you receive a call from someone asking for your bank details, such persons always pretended to be calling from your bank. Try visit your bank physically for such records updates

4.1.4 PIN-Cracking

- ✓ Do away with or preferably shred your ATM receipts, balance enquiries or mini-statements when you dispose of them.

- ✓ Always change your default PIN given your by the bank.

- ✓ Don't use easily guessed PIN such as birthday, house number, phone number etc.

5. CONCLUSIONS AND RECOMMENDATIONS

In this research, we found out that 57 respondents frequently use and have knowledge on ATM out of the total 438 respondents. We observed that about 13% of the respondents had knowledge on ATM frauds. This shows that users of ATM and it services in the municipality have little or no knowledge on the various frauds associated with ATM services, making them vulnerable to ATM attacks.

The recommendations of this research could be summarized as follows:

- ✓ Since the main source of information on ATM to customers is from their respective bank, we recommend that the banks should provide education on ATM frauds to its customers in a regular processes.

- ✓ Customers should report immediately when their ATM card is trapped in the ATM machines.

- ✓ ATM services users should read more on their own about the various forms of ATM frauds mechanism to prevent themselves from being a victim.

6. ACKNOWLEDGMENTS

We offer our sincere praises and thanks to God Almighty for how far He has kept, protect and brought us faithfully in life.

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Design of Low Noise Amplifier

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Abstract: *The value of capacitors and inductors placed are simulated based on characteristic equations derived from electron movements. In this paper, a statistical learner is used to help run the simulator.*

Keywords: *Statistical learner, low noise amplifier*

1. INTRODUCTION

The value of capacitors and inductors placed in the input and output circuit of a low noise amplifier is simulated based on characteristic equations derived from electron movements.

1.1 Theory

Assume L1, C1 are placed in the input circuit and L2, C2 are placed in the output circuit. {(L1,C1),(L2,C2)} pair creates a specific filter. This filter is used to learn the modulation of a low noise amplifier. The 2nd pair is classified into four quantisation pairs while the 1st pair is clustered into 12 such pairs as quantised clusters. Output values are fixed as the output of the filter which are initiated as the signal filtered only from input, signal filtered only from output and difference of these two values differently by 2 numbers.

1.2 Indentations and EQUATIONS

Outputs:
1 -> signalfrom(L1,C1)
2 -> output4-output1*1/3
3 -> output4-output1*2/3
4 -> signalfrom(L2,C2)

Mathematically the proposed 1×4 sized output vector O = [g1g2g3g4] is related with 1×5 sized input vector I = [G1G2G3G4G5] (which are obtained from the arbitrary 3×3 sized green channel) in the

following manner. H = f1 (I×W1+B1) and O = H×W2+B2where H is 1×2 sized hidden vector, W1 is 5×2 sized weight matrix (between input layer and hidden layer), B1 is 1×2 sized biased vector at hidden layer, W2 is 2×4 sized weight matrix (between hidden layer and output layer), B2 is 1×4 sized bias vector at the output layer. f1 is chosen as the nonlinear function logsig(n) = 1

1+exp (−ȯ)

. Suppose the digital image captured using the digital camera is subjected to manipulation like rotation, resize, scaling etc. using the image edit tool boxes like photo shop and paint the relationship above gets distorted and is no more valid. The values of the above mentioned matrices and vectors (W1, B1, W2 and B2) are arranged in a single row to obtain a feature vector of size 1×24. Thus the feature vector of size 1×24 obtained as described helps in identifying whether the particular part of the image is original or forged. The proposed feature vector is [W1 (stacked in a single row) W2 (stacked in a single row) B1 (stacked in a single row) B2 (stacked in a single row)]

Proposed forgery detector

From each of the image, 500 3×3 sub blocks were collected at random. 1×5 sized input vectors and the corresponding 1×4 sized output vectors were collected from every 3×3 sub blocks of the green channel matrix. In a Bayer array filter the number of green sensors is more than the number of red and blue sensors. So, in this paper we have used the green values taken from the image to model the neural network.

The feature vectors are obtained as mentioned in section 2. This vector completely describes the interpolation elationship. The input and output vectors collected from these 500 sub blocks were used to train the BPN to get one feature vector of size 1×24. This is repeated for all the input output vectors from each image and this formed the feature vectors for the original images. Doctored images were created by copy paste, resize, rotation etc. and the input and output vectors were collected from the doctored part of the image and the above steps were repeated to extract feature vectors for the forged images.

To check the accuracy with which the neural network has modeled the camera 50 such sub blocks were taken from the same image and the predicted outputs and the corresponding original values were plotted. Expected values are the values taken from the corresponding pixel of each image (interpolation done by the camera) and predicted values are those done by the trained neural network.

Dimensionality reduction, training the classifier and testing phase About 100 feature vectors were collected from both original and forged images. 50 such feature vectors (collected from 4 different cameras in case they were from original data set) of them were used for training. They were projected onto kernel space (7 different kernels were used) and LDA was performed to reduce their dimension from 1×24 to 1. This one dimensional data was used to train our classifier. We used three different types of classifier: SVM, nearest neighbor and nearest mean. Five different kernels were used for SVM. The remaining 50 feature vectors were used for testing. Their dimensions were reduced from 1×24 to 1 as in the testing phase and were fed as inputs to the three different classifiers. The outputs are tabulated in Table 1.

2. REFERENCES

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Rocket Launcher Protocol

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Abstract: The trajectory of a rocket launcher is hereby modelled using signal processing.

Keywords: opamps

1. INTRODUCTION

The trajectory of a rocket launcher is hereby modelled using signal processing. The energy gained is energy lost in its trajectory. To reach an impact threshold signal processing algorithms are used for the rocket to gain acceleration. Thus the rocket launcher is hereby modelled as a input signal reaching the target with the desired acceleration. The viscosity of air causing changes to the rocket is modelled as an operational amplifier.

2. CONCEPTS INVOLVED

Launch speed and energy to be a parameter. Launch direction is another parameter.

General structure for rocket launcher:

Initial velocity = u

Final velocity = v

Acceleration applied = variable (depending on electronic concept used)

v = u + at

E_final = E_initial as explained above

(iff) a = g

To concentrate:

Final velocity and final energy

Acceleration is changed accordingly with the help of electronics.

Properties:

a) Geometry to decide direction of missle

b) Energy is decided by the design of circuit inside the missle.

The point b is discussed as below.

Air is modelled as an operational amplifier ie. Input, R1, R2 and output in negative feedback amplifier.

Output = -R2/R1 x Input

Voltage is inverted at the output in this structure.

Energy = 1/2 x m x v xv as potential energy = 0 in both the ends.

Voltage is a modelled graph and opamp is modelled resistance of air + gravity.

Therefore the resistance (ie. acceleration) is modelled as R2/R1.

The output voltage = -a x input voltage

The voltage relates to velocity as v = u + at = -at if u = 0

ie. Final velocity = -at

From analysis horizontal velocity is not modelled in this form and only vertical velocity is modelled as velocity.

Therefore initial vertical velocity is zero

If final vertical velocity is v, energy gained = 1/2 x m x v xv = energy gain

a = R2/R1 = g x 1/R1

Resultant acceleration a = g + ax = g/R1

g(1-1/R1) = ax

ax = g(R1-1)/R1

Energy gain = 1/2 x m (gxg + ax x ax + 2gax) x t x t

ax is computed using mean squared computation.