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Data Mining In E-Money and Its Security

Arti R.Tiwari
Student, B.E. Final Year Computer Science and Engineering,
H.V.P.M, C.O.E.T, Amravati, India

Abstract—No doubt, our modern society is gradually catching the cashless syndrome. E-payments, ATM cards and others are now the order of the day at our work-places. This paper takes a keen look into the feasibility of introducing cashless means of business transactions into our society and the security threats associated with it. The paper explains the potentials of applying data mining techniques to effectively control the security threats and finally presents a model for knowledge extraction in a cashless environment.
Index Terms – Cashless Society, Cashlessness, Electronic Money and Data Mining.

I. INTRODUCTION

The study of e-cash as the main engine driving global economic activity will determine the future shape of society. It is broadly defined as an electronic store of monetary value on a technique device that may be widely used for making payments to entities. Virtual shopping, the digital economy, e-cash, e-commerce - these are just a sample in the range of economically-laden terms that have cropped up in recent years to accompany the plethora of new vocabulary spawned by the development and commercialization of the Internet. While most people either know or can guess at what these terms mean, fewer realize the motivations and implications that lie behind the expressions which are being thrown at us by the western world- and even by us. For centuries, coins, notes and cheques were the only elements for paying in exchange of expenders. Data Mining Technology in Business New York City taxicabs are rigged with electronic card readers. Increasingly, paychecks are electronically deposited, and the money for the bills they pay – mortgages, utilities, cable and phone are paid electronically as well. Banks offer incentives to consumers for using these direct-pay options, which allow them to keep better tabs on their customers and their money. Welfare and food stamps are issued on cards, which can be downloaded at the register or through an automatic teller machine. As at 2003, the US Federal Reserve Bank said 2003 was the year electronic payments trumped checks as the method of choice. That year, there were 44.5 billion e-payments, compared with 36.7 billion checks. *The Australian* (CeBIT), an Australian daily Newspaper recently reported that the number of Australians withdrawing cash from ATMs has dropped to its lowest point in over six years, signaling that consumers are reducing their over the counter cash transaction changes. Debit and credit card analysis firm MWE Consulting found that debit card ATM withdrawals fell by 6.3 per cent to 2.39 per month in 2009. Monthly transactions peaked in 2006 with an average of 2.62 cash withdrawals each month. The arrival of the smartphones; and the development of 3G networks which transfer all information quickly, plus the creation of new applications and services by banks and retailers are bringing cashless-ness nearer to us. Orange, one of the Europe‘s mobile network companies is quickly launching its Quick Tap system, which will let one to buy goods up to £15 at "wave and pay" contactless readers already installed in 50,000 UK stores. But the system will initially only work with one handset – the Samsung Taco Lite– though more are promised later, and is operated only through Barclaycard. And another network, O2's more advanced offering will let one‘s phone host several bank and credit cards and permit purchases above £15 while inputting a pin. It will also allow one to text money. So that if one owes someone a penny he will be able to send it from his phone to theirs. Thus, even for low-price purchases, a new generation of mobiles could eventually mean the end for coins and notes. The above suggests that "Mobile banking has truly come of age as people no longer see the ability to effectively manage their finances by mobile as a novelty or a 'nice to have', but increasingly as the norm".

II. CASHLESS SOCIETY INSTRUMENTS

In this section, we describe briefly some of the electronic instruments facilitating driving the force of electronic society. Card-based alternatives to cash payments are now well established, with credit and debit cards in popular usage. Additionally, new technology has enabled the development of so-called smartcards where additional data can be stored on a microchip.

A. Credit And Debit Cards

Credit cards are typically a plastic card (figure 1) with data stored on a magnetic stripe and, increasingly, a microchip. The majority of cards are the same size of 85.60 × 53.98 mm, as set forth by the ISO 7810 international standard. Between 1971 and 2001, the number of cards per household in the United States grew from 0.8 to 7.6. Similar in appearance and usage to credit cards, debit cards are a further popular alternative to the use of cash when making purchases. The major difference, as the name

suggests, is that in this case funds are withdrawn directly from the purchaser‘s bank account, rather than accumulating credit which then has to be paid off at a later date, potentially with interest. Debit cards became popular later than credit cards, but are particularly favored by the banks over alternative more traditional payment methods, such as cheques, which are much more costly for them to process.

Fig. 1: Credit cards issued by VISA and MasterCard

B. Smart Cards

A smart card is a plastic card, similar in appearance to a credit card, and containing one or more embedded semiconductor chips. Smart cards typically have a storage area in EEPROM and also include a microprocessor able to process any data stored. Recent technological progress has seen the development of a ―contactless smart card, in other words one in which the chip communicates with a card reader using radio frequency identification. Smart cards have significant potential over magnetic-stripe swipe cards, not only can more data be stored, but it can be processed in some way as well. Despite privacy concerns, it seems likely that smart cards are the way forward, with increasing systems merging together. In an article for Credit Union Magazine, predicts that ―as smart cards gain momentum in the financial services marketplace, it’s likely that other forms of plastic like credit, debit, and ATM cards will all meld into one universal, multifunctional smart card. The first major use of smartcards was by French banking association Cartes Bancaires who saw advantage of using the technology in reducing fraud. By replacing magnetic striped cards with smart cards fraud rates in France dropped tenfold.

C. Stored-Value Cards

Stored value cards are typically similar in appearance to credit cards and either employs a magnetic stripe or smart card technologies in order to store data. Under this scheme, using an appropriate reader an amount can be electronically added or deducted from a balance on the card. As at the year 2002, such a scheme was seen by some as an ―initial step toward a cashless society.

D. Electronic Cash

Several companies have taken this idea further and developed cards which can be used in multiple retail outlets, effectively as ―electronic cash. One such system is Mondex, developed by the National Westminster Bank in the UK and later sold to MasterCard International. Mondex was originally developed in 1996 as a ―smart card alternative to cash. Graham Higgins, a banker and co-inventor of Mondex, had been quoted as explaining that the scheme would help alleviate ―the burden of counting, storing, as well as the security associated with, physical cash.

E. Point Of Sale Terminals– Automated Cash Register (ACR).

Point of sale (POS) or checkout is the location where a transaction occurs. A "checkout" refers to a POS terminal or more generally to the hardware and software used for checkouts, the equivalent of an electronic cash register. A POS terminal or machine manages the selling process by a salesperson accessible interface. The same system allows the creation and printing of the receipt. Point of Sale (POS) Terminals are the preferred way of processing credit cards, debit cards, cheques, smart chip cards, electronic benefits transfer (EBT), and other electronically submitted transactions in a traditional retail environment. The terminals are used in "face-to-face" transactions. The merchant will swipe the customer‘s card through the terminal or key-in payment information and the terminal does the rest.

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Fig. 2: PoS Terminals (Source: Wikipedia – POS)

F. ATM Cards

An Automated Teller Machine (ATM) card is a card issued by a bank, credit union or building society that can be used at an ATM for deposits, withdrawals, account information, and other types of transactions, often through interbank networks. ATM cards are typically about 86 × 54 mm. Unlike a debit card, in-store purchases or refunds with an ATM card can generally be made in person only, as they require authentication through a personal identification number or PIN. In other words, ATM cards cannot be used at merchants that only accept credit cards. However, other types of transactions through telephone or online banking may be performed with an ATM card without in-person authentication. This includes account balance inquiries, electronic bill payments or in some cases, online purchases.

Fig. 3: An ATM Card (Source: Wikipedia– ATM Card)

III. PROBLEMS AND PROPOSPECTS

The main issue of having a cashless society is whether the benefits would outweigh disadvantages. It is important that, if society moves toward a cash free economy, the benefits must outweigh the negative aspects in the end. There are major social and economic benefits to a cashless society such as reduction in cash related crimes and monetary benefits. There are major negative implications with a cashless society such as privacy issues and losing the liberty of cash. A cashless society could only be implemented by the government since the government is the organization that prints and controls the supply of cash in society. With the study of a cash free society this means is that the government would be able to monitor purchases, spending habits and businesses patronized. The real danger is too heavy a hand watching over your life. It's nobody's business where you spend your money so long as you earn it legally. No government entity should know where you spend money for groceries. The main disadvantages of a cashless society consist of privacy issues and computer hackers. One of the main issues regarding the implementation of a smart card/chip that would record and control all financial transactions electronically is the assault on privacy. With all private monetary data exposed to government officials many citizens may believe that the government has substantial power over society by having access to these types of confidential information. People value their ability to make some of their purchases using cash, with absolutely no record, electronic log, or audit trail of those transactions, as a way to safeguard their privacy. Another major disadvantage with a cashless society is the risk of computer hackers. ―Computer experts, so-called "Yahoo-Yahoo Boys", who trick unsuspecting individuals, groups and organizations online to part with their money, might alter records, create fictitious millionaires, set up dummy companies, and so on. In short, they could create an electronic underground society as well as contribute to the issue of identity theft. Security is clearly of crucial importance in considering any alternative to physical cash. At the root of this lies the problem of authentication, i.e. the process of verifying the identity of a person. This is typically performed by examining some identifying information such as a password or digital signature. One of the obvious and most commonly used form of authentication is a password; in the context of payment systems more commonly implemented as a personal identification number (PIN). Such a system has long been in place for

authenticating users of cashpoints prior to withdrawing money. However, technological advances meant that criminals have been increasingly successful in making copies of the data stored on the magnetic stripe, and forging signatures in order to commit fraud. Over £402 million was lost in UK through ―plastic card fraud in 2003, which has led to the advancement of a new system, marketed in the UK under the name Chip and PIN'5. Cashlessness requires that all of society's stakeholders—organizations, financial institutions, governments and individuals—agree on and trust in digital currency. With the global meltdown and continuing fallout in the financial services industry, people are more comforted by the physical and less likely to put all of their confidence in banks and other financial institutions. Payment processes are the first frontier of a cashless society and will also provide the spark for innovation. Because currently the infrastructure and technology required supporting new payment technologies remains largely disconnected. As the world increasingly relies on digital currency, all banks—big and small—will have to evaluate and in some cases enhance their existing technology to reduce errors, increase efficiencies and add transparency. In many cases, the greatest push will be for systems that can deliver end-to-end visibility of the transaction process since accountability will be a major factor in any wide-spread cashless initiatives. Statistics has shown that electronic payment transactions are quickly replacing cheques. The electronic means mentioned previously is rapidly squeezing the cheque out of the banking scene. The Australian Bankers Association states that the value of cheque transactions fell by 50% between the years 1998 and 2002 . There are numerous perceived advantages often associated with the notion of a cashless society. Firstly, cash is bulky and heavy to carry by the customer. A cashless solution, even a smart card, may well be smaller and lighter. Even a credit or debit card, popular in society today, is significantly lighter than a £1 coin. Electronic solutions also make it a possibility to carry much larger quantities of money around – effectively this could mean carrying one's entire personal wealth. There are also huge costs associated with the overhead of processing physical cash. Primarily, there are costs associated with the production of a large number of coins and banknotes – a cost borne ultimately by the taxpayer. There are also costs associated with the secure transportation of money.

IV. A DATA MINING MODEL FOR EXTRACTING KNOWLEDGE IN A CASHLESS ENVIRONMENT

The model presented in Fig. 4 depicts a situation in which the daily transaction data are extracted from server logs of co-operating financial institutions, aggregated and finally subjected to data mining activities. The transaction data has to be extracted via the Internet with a secure network protocol.

From the data aggregation phase, useful data for data mining will be selected, preprocessed and transformed into a suitable data mining structure. Thereafter a data mining task such as classification or prediction is performed using an appropriate algorithm, such as Artificial Neural Network (ANN). Finally, hidden knowledge, such as patterns of spending by people, from the transaction data will surface. The knowledge so-discovered can be used by decision-makers (the government machineries) and even the financial houses for effective management and administration.

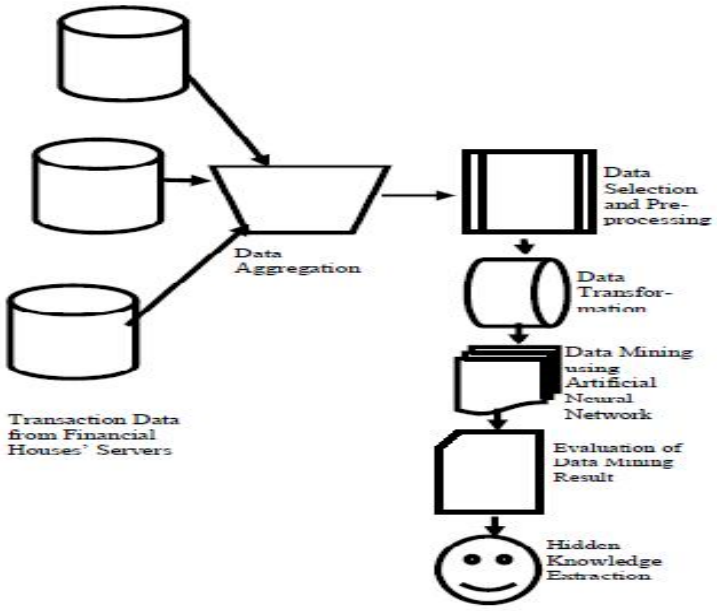

Fig. 4: A model for extracting knowledge from transaction data

V. CONCLUSION

Electronic cash is a system which allows individuals to purchase goods or services in today‘s society without the exchange of anything tangible. The term money still exists, but it is more in an electronic form than previously. This is the ultimate goal of cashless society paradigm. This paper has identified some of the important issues which have been, or will be encountered in cashless society brought on in part by electronic cash. By and large, the paper has exposed researchers to a new frontier of research potential– Data Mining.

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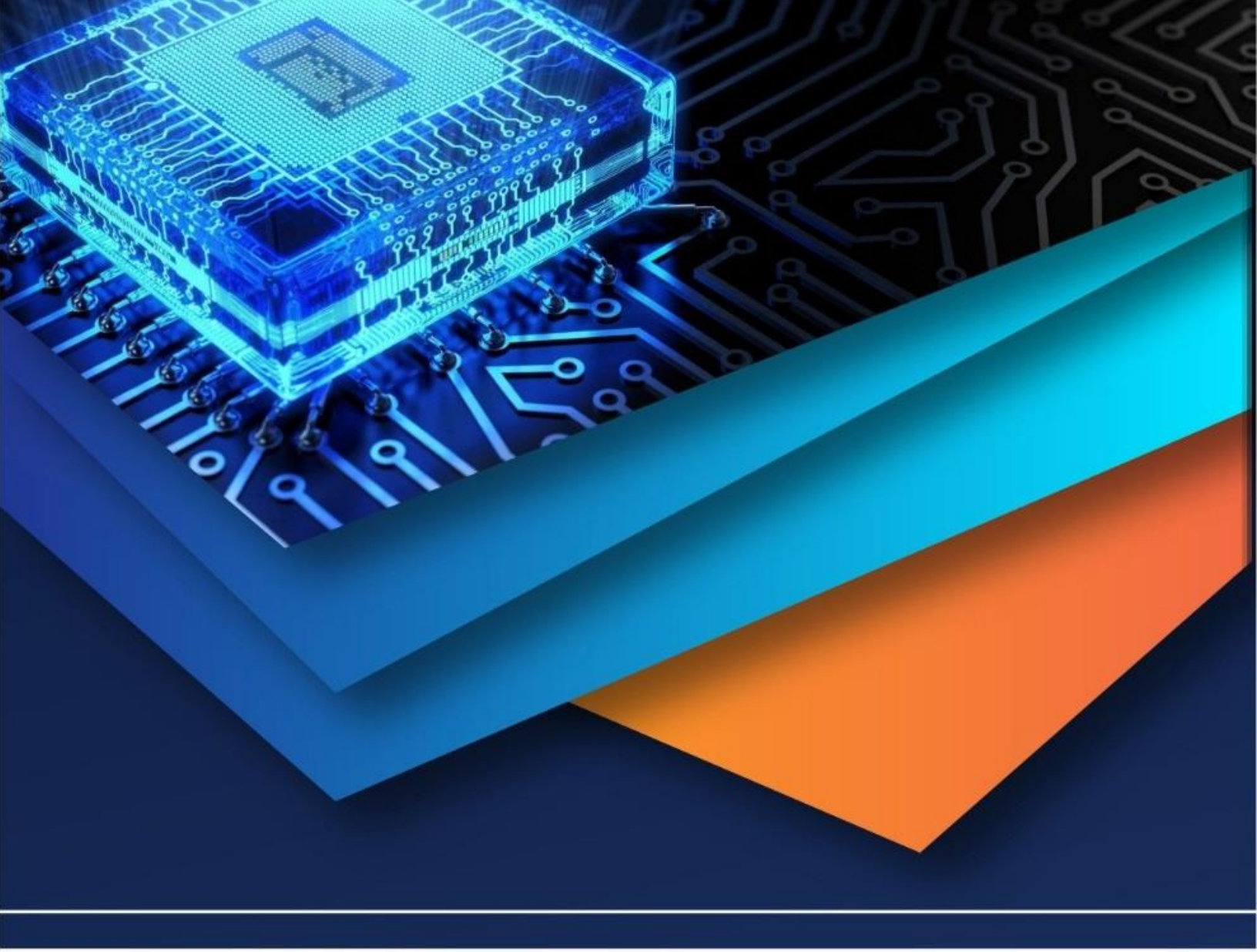

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