CSC-370
E - Commerce
(BSc CSIT, TU)

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Chapter 3 – Electronic Payment Systems

- Method to make payments online in e-commerce systems.
- major cashless payment system in online business process
- Electronic payment systems and e-commerce are linked as online consumers must pay for products and services
- This payment systems must be secure, have a low processing cost, and be accepted widely as global currency
- Issues are :
  - What form and characteristics of payment systems - for example, electronic cash, electronic checks, credit/debit cards will consumers use
  - In online markets, how can we manage the financial risk associated with various payment systems- privacy, fraud, mistakes, as well as other risks like bank failures? What security features (authentication, privacy, anonymity) need to be designed to reduce these risks

Types of Electronic Payment Systems

- Electronic payment systems are growing rapidly in banking, retail, health care, online markets, and even government - in fact, anywhere money needs to change hands.
- Work on EFT(Electronic Fund Transfer) can be segmented into three broad categories
  1. Banking and financial payments
     - Large-scale or wholesale payments (e.g. bank-to-bank transfer)
     - Small-scale or retail payments (e.g. automated teller machines and cash dispensers)
     - Home banking (e.g. bill payments)
  2. Retailing Payments
     - Credit cards (e.g. VISA or MasterCard)
     - Charge cards (e.g. American Express)

Types of Electronic Payment Systems

- Work on EFT(Electronic Fund Transfer) can be segmented into three broad categories
  3. Online electronic commerce payments
     - Token-based payment systems

       (Electronic cash, Electronic checks, Smart cards or debit cards)
     - Credit card-based payment systems

- Retail payments and large-scale payments between banks and business are widely recognized as the pioneering efforts in electronic commerce that involve the extensive use of EDI for transferring payment information

Risks Associated with Electronic Payment System

- Electronic payment is a popular method of making payments globally.
- It involves sending money from bank to bank instantly, regardless of the distance involved
- Such payment systems use Internet. Electronic payment systems are popular because of their convenience, however, they also may pose serious risks to consumers and financial institutions as :
  - **Tax Evasion**
  - **Fraud**
  - **Impulse Buying**
  - **Payment Conflict**

Risks Associated with Electronic Payment System

- **Tax Evasion :**
  - Tax evasion is an illegal activity in which a person or organization deliberately avoids paying a true tax liability
  - Businesses are required by law to provide records of their financial transactions to the government so that their tax compliance can be verified but e-payment however can frustrate the efforts of tax collection
  - the government may not know the truth, which could cause tax evasion
- **Fraud :**
  - Electronic payment systems are prone to fraud.
  - The payment is done usually after keying in a password and sometimes answering security questions.
  - There is no way of verifying the true identity of the maker of the transaction.
  - As long as the password and security questions are correct, the system assumes you are the right person.
  - If this information falls into the possession of fraudsters, then they can defraud you of your money

Risks Associated with Electronic Payment System

- **Impulse Buying :**
  - Electronic payment systems encourage impulse buying, especially online.
  - You are likely to make a decision to purchase an item you find on sale online, even though you had not planned to buy it, just because it will cost you just a click to buy it through your credit card.
  - Impulse buying leads to disorganized budgets and is one of the disadvantages of electronic payment systems
- **Payment Conflicts :**
  - Payment conflicts often arise because the payments are not done manually but by an automated system that can cause errors.
  - This is especially common when payment is done on a regular basis to many recipients.
  - If you do not check your pay slip at the end of every pay period, then you might end up with a conflict due to these technical glitches, or anomalies

Digital Token based Electronic Payment Systems

- None of the banking or retailing payment methods is completely adequate in their present form for the consumer-oriented e-commerce environment.
- there may be a sufficient delay in the payment process for frauds, overdrafts, and other undesirables to be identified and corrected
- many of these payment mechanisms are being modified and adapted for the conduct of business over networks
- Entirely new forms of financial instruments are also being developed
- One such new financial instrument is "**electronic tokens**" in the form of electronic cash/money or checks
- Electronic tokens are designed as electronic analogs of various forms of payment backed by a bank or financial institution.
- Simply stated, electronic tokens are equivalent to cash that is backed by a bank

Types of Electronic Tokens

- There are three types of electronic tokens
  - **Cash or Real-Time :** Transactions are settled with the exchange of electronic currency. An example of online currency exchange is electronic cash (e-cash).
  - **Debit or Prepaid :** Users pay in advance for the privilege of getting information. Examples of prepaid payment mechanisms are stored in smart cards and electronic purses that store electronic money
  - **Credit or Postpaid :** The server authenticates the customers and verifies with the bank that funds are adequate before purchase. Examples of postpaid mechanisms are credit/debit cards and electronic checks

Electronic Cash (e-cash)

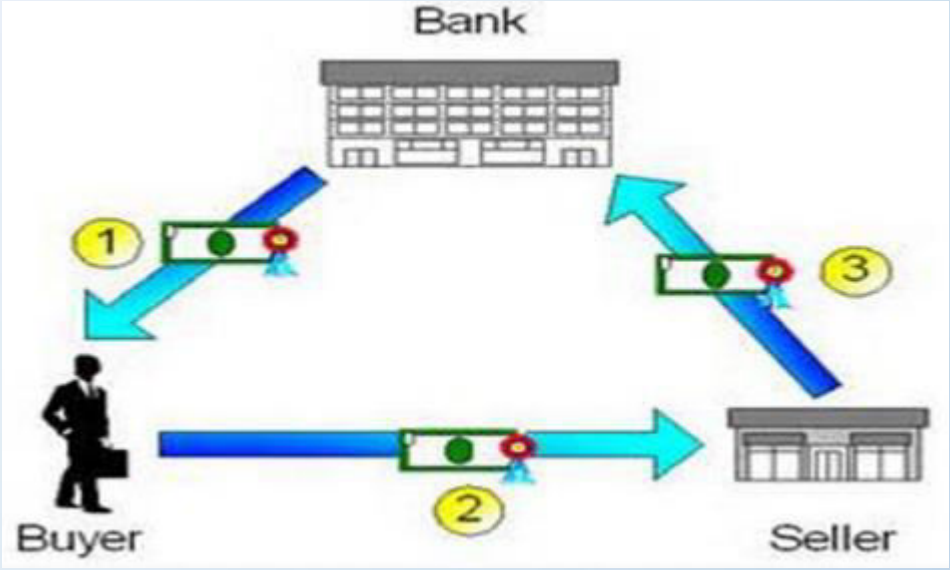
- It is a new concept in online payment systems because it combines computerized convenience with security and privacy that improve on paper cash.
- Its versatility opens up a host of new markets and applications.
- E-cash presents some interesting characteristics that should make it an attractive alternative for payment over the Internet
- It focuses on replacing cash as the principal payment vehicle in consumer-oriented electronic payments
- Cash remains the dominant form of payment for three reasons:
  - lack of trust in the banking system,
  - inefficient clearing and settlement of noncash transactions
  - negative real interest rates paid on bank deposits

Electronic Cash (e-cash)

- Electronic cash is one of the instruments that can be used to conduct paperless transactions
- Paperless transaction is a term used to describe financial exchanges that do not involve the physical exchange of currency
- monetary value is electronically credited and debited
- Often called e-cash or digital money, and is commonly used to conduct distant transactions, such as those between parties on the Internet and those between parties in different countries
- Eg. E-cash can allow a freelancer in Nepal to be paid for work that he did for a contractor present anywhere in the world. (Paypal, esewa)

Electronic Cash (e-cash)

- One advantage of e-cash is that it eliminates the apprehension that many people feel about carrying and exchanging paper currency.
- Another advantage of e-cash is that it is usually easily converted to another currency, making traveling and international business substantially easier



Transaction of e-cash

Electronic Cash (e-cash)

- Ideal properties of a Digital Cash system should be :
  1. **Secure :** Alice should be able to pass digital cash to Bob without either of them, or others, able to alter or reproduce the electronic token
  2. **Anonymous :** Alice should be able to pay Bob without revealing her identity, and without Bob revealing his identity. Moreover, the Bank should not know who Alice paid or who Bob was paid by. Even stronger, they should have the option to remain anonymous concerning the mere existence of a payment on their behalf
  3. **Portable :** The security and use of the digital cash is not dependent on any physical location. The cash should be able to be stored on disk or USB memory stick, sent by email, SMS, internet chat, or uploaded on web forms. Digital cash should not be restricted to a single, proprietary computer network. Eg. Electronic Cash Registers
  4. **Offline Capable :** The protocol between the two exchanging parties is executed offline, meaning that neither is required to be host-connected in order to proceed

Electronic Cash (e-cash)

- Ideal properties of a Digital Cash system should be :
  5. **Wide acceptability :** The digital cash is well-known and accepted in a large commercial zone. With several digital cash providers displaying wide acceptability, Alice should be able to use her preferred unit in more than just a restricted local setting
  6. **User-friendly :** The digital cash should be simple to use from both the spending perspective and the receiving perspective. Simplicity leads to mass use and mass use leads to wide acceptability

Pros and Cons of the online electronic cash system

- **Pros :**
  - Provides fully anonymous and untraceable digital cash
  - No double spending problems (coins are checked in real time during the transaction).
  - No additional secure hardware required
- **Cons :**
  - Communications overhead between merchant and the bank
  - Huge database of coin records - the bank server needs to maintain an ever-growing database for all the used coins' serial numbers
  - Difficult to scale, need synchronization between bank servers

Electronic Checks

- An electronic check, or e-check, is a form of payment made via the Internet, or another data network, designed to perform the same function as a conventional paper check.
- Additionally, it has more security features than conventional paper check including authentication, public key cryptography, digital signatures, and encryption, etc.

Electronic Checks

- Generally, the costs associated with issuing an electronic check are notably lower than those associated with paper checks
- Electronic checks can be used to make a payment for any transaction that a paper check can cover, and are governed by the same laws that apply to paper checks
- Generally, the costs associated with issuing an electronic check are notably lower than those associated with paper checks.
- Electronic checks also come with a lower risk of the associated funds being stolen, as there is no tangible item to intercept
- eChecks use the Automated Clearing House (ACH) to direct debit from a customer's checking account into a merchant's business bank account, with the help of a payments processor

How Electronic Checks work?

- In order to accept eCheck payments, a business must first obtain the customer's information including their bank routing and checking account numbers.
- This information can be obtained online, by phone, or in person via a paper form.
- Most businesses today have websites and can provide a secure form page for this customer information
- Using this information, the merchant's bank can communicate directly with a customer's bank.
- Once the funds are verified, the direct debit happens via ACH(Automated Clearing House)

How Electronic Checks work?

- Following are the parties involved in ACH electronic check payment processing
  1. **An originator :** The merchant cashing the eCheck. The originator initiates the direct deposit process by obtaining the necessary information from the customer
  2. **The business bank :** The originator's bank, also called the Originating Depository Financial institution (ODFI). The business bank places the ACH entry at the originator's order, aggregates payments from a variety of customers, and sends the payments in batches to an ACH operator.
  3. **An ACH operator :** The ACH operator sorts the fund request and settles the funds into the business bank.
  4. **The customer's bank :** a Receiving Depository Financial Institution (RDFI) receives the request, verifies that the funds are available, debits the customer's account and credits the business account.

Benefits of Electronic Checks

- Saves you time with your deposits - no more bank runs or long teller lines
- Lowers traditional bank fees, like per item deposit and returned item fees
- Funds you quickly
- Secures your customer’s personal and bank account information by returning the original item to the check writer
- Expandable equipment is simple and user friendly

Smart Cards

- A smart card is a device that includes an embedded integrated circuit chip (ICC) that can be either a secure microcontroller or equivalent intelligence with internal memory or a memory chip alone
- The card connects to a reader with direct physical contact or with a remote contactless radio frequency interface.
- With an embedded microcontroller, smart cards have the unique ability to store large amounts of data, carry out their own on-card functions (e.g., encryption and mutual authentication) and interact intelligently with a smart card reader

Smart Cards

- Smart card technology is available in a variety of form factors, including plastic cards, fobs, subscriber identity modules (SIMs) used in GSM mobile phones and etc
- Based on the working mechanism, there are three types of smart cards :
  - Contact Smart Card
  - Contactless Smart Card
  - Hybrid Smart Card

Smart Cards

- **Contact Smart Card :**
  - most common smart cards in use.
  - ATM cards, most credit cards, SIM cards etc fall into this category.
  - the cards should be inserted into card readers, it reads the information stored on the contact pad and carry out transactions as required

Smart Cards

- **Contactless Smart Card :**
  - these cards do not require a reader.
  - It works using Near Field Communication technology or using radio frequencies which establishes wireless communication between the smart card and card reader.

Smart Cards

- **Hybrid Smart Card :**
  - Hybrid cards are cards with dual capacity.
  - These cards can work both on contact and contactless card readers.
  - These cards are quite rare in use
  - This type of smart card can has two chips, one with a contact interface and one with a contactless interface
  - **A dual-interface card** has a single chip with both contact and contactless interfaces and it is possible to access the same chip using either a contact or contactless interface

Applications of Smart Cards

- **Secure identity applications :**
  - employee ID badges, citizen ID documents, electronic passports, driver's licenses, online authentication devices
- **Healthcare applications :**
  - citizen health ID cards, physician ID cards, portable medical records cards
- **Payment applications :**
  - contact and contactless credit/debit cards, transit payment cards
- **Telecommunications application :**
  - GSM Subscriber Identity Modules, pay telephone payment cards

Online Stored Value Payment System

- Stored value systems are a form of electronic payment technology
- They coexist with credit and debit technology and principally target the low value transactions
- Online stored value systems have very low transaction cost.
- Stored value systems are based on creating a form of electronic value, for example on smart cards or as computer files.
- The value can be bought (withdrawn) anytime
- Today Stored Value Cards (SVC) are one of the most dynamic and fastest growing products in the financial industry
- One leading difference between SVC and debit cards is that debit cards are usually issued in the name of the account holders. In contrast Stored Value Cards are usually anonymous.
- The notion "stored value" means the funds and data which is stored on the card
- Eg: fare cards, telephone prepaid cards etc.

Digital Wallets

- A digital wallet is an electronic method for securely storing various types of sensitive information, including credit cards, debit cards, gift cards, electronic cash, tickets, and IDs.
- Not every wallet stores every type of payment information. While terms such as digital wallet, mobile wallet, and e-wallet all mean roughly the same thing, they technically cover slightly different services
- Eg : Apple Pay, Google Pay, and Samsung Pay, paypal etc

Digital Wallets : Major Functions

- **Store Credit & Debit Card Information :** Digital wallets can store information of debit and credit cards. Some, allow payment directly from the card as well
- **Pay At A Store**
- **Peer-To-Peer (P2P) Payments :** Most digital wallets allow users to transfer funds to one another. Typically, these payments are small amounts used to split a lunch bill, pay a babysitter, or even pay a share of the rent
- **Online Payments :** Digital wallets can be used to pay for online or in-app purchases
- **Hold Coupons & Loyalty Cards :** Many digital wallets can hold coupons or loyalty cards, so a user can be given the appropriate credit or discount for using a particular card or shopping at a specific store
- **Security :** All digital wallets have hardware and software security features that keep the stored information safe

Peer-to-peer payment systems

- Peer-to-peer payment systems, also known as P2P payments or money transfer apps - like Venmo, PayPal and Cash App allow users to send one another money from their mobile devices through a linked bank account or card.
- These payments allow the transfer of funds between two parties using their individual banking accounts or credit cards through an online or mobile app
- for whichever platform you choose, you'll sign up for an account then link your bank account or credit or debit card to it.
- Some apps might require further verification information and passwords to increase security. After your account is set up you can find other users by their username, their email, or your phone contacts.

Virtual Currency

- Virtual currency is a type of unregulated digital currency that is only available in electronic form
- It is stored and transacted only through designated software, mobile or computer applications, or through dedicated digital wallets, and the transactions occur over the internet through secure, dedicated networks.
- Virtual currency is considered to be a subset of the digital currency group, which also includes cryptocurrencies, which exist within the blockchain network
- Virtual currency is currency held within the blockchain network that is not controlled by a centralized banking authority
- Virtual currency is different than digital currency since digital currency is simply currency issued by a bank in digital form
- Eg : bitcoin, pi etc

Virtual Currency

- Virtual currency can be defined as an electronic representation of monetary value that may be issued, managed, and controlled by private issuers, developers, or the founding organization.
- Such virtual currencies are often represented in terms of tokens and may remain unregulated without a legal tender.
- Along with use by the common public, a virtual currency can have restricted usage, and it may be in circulation only among the members of a specific online community or a virtual group of users who transact online on dedicated networks.
- Due to lack of a centralized regulatory authority, virtual currencies are prone to wide swings in their valuations

Electronic Billing Presentment and Payment (EBPP) System

- is a process that companies use to collect payments electronically through systems like the Internet, direct-dial access, and Automated Teller Machines
- It has become a core component of online banking at many financial institutions today.
- Other industries - including insurance providers, telecommunications companies, and utilities depend on EBPP services as well.

Electronic Billing Presentment and Payment (EBPP) System

- There are two types of EBPPs
  - **biller-direct**
  - **bank-aggregator**
- **A biller-direct** EBPP lets users pay bills directly via the company's website for goods or services and might alert them when a payment is due via email.
- The customer then logs into the site via a secure connection, reviews the billing information, and enters payment amount
- **The bank-aggregator** model allows customers to pay bills to many different companies through one portal.
- That is, the service collects different payments from customers and distributes each payment to the appropriate company
- A bank, for instance, might offer online users the option to make many different payments like credit cards, utility bills, and insurance premiums.
- Standalone sites also exist that allow people to view and pay all of their bills

EBPP and Online Banking

- Many large banks offer electronic bill payment and presentment services as a part of their online banking system
- Online banking allows users to execute financial transactions via the Internet.
- Specifically, an online bank offers customers the ability to make deposits, withdrawals, transfers between accounts, and other traditional services, as well as online bill payments, such as EBPP
- Eg : Prabhu bank has its app that allows customers to pay different bills online.

Auctioning in E-Commerce

- An e-auction is a transaction between sellers(the auctioneers) and bidders (suppliers in business to business scenarios) that takes place on an electronic marketplace.
- It can occur business to business, business to consumer, or consumer to consumer, and allows suppliers to bid online against each other for contracts against a published specification
- This kind of environment encourages competition, with the result that goods and services are offered at their current market value

Types of E-Auction

- **English Auction :** English auctions are where bids are announced by either an auctioneer or the bidders, and winners pay what they bid to receive the object. The most common and straightforward form of e-auction, they're intuitive, user-friendly and can help to reduce transaction costs
- **Dutch auction :** Dutch auctions start at a high price, which is then incrementally lowered until a buyer accepts the price. The first person to bid wins the auction, which makes them good for quick decisions
- **First-price sealed-bid :** When a single bid is made by all bidding parties and the single highest bidder wins, and pays what they bid. The main difference between this and English auctions is that bids are not openly viewable or announced as opposed to the competitive nature which is generated by public bids.

Types of E-Auction

- **Vickrey auction :** A Vickrey auction, sometimes known as a second-price sealed-bid auction in which bidders submit written bids without knowing the bid of the other people in the auction. The highest bidder wins but the price paid is the second-highest bid. This type of auction is strategically similar to an English auction and gives bidders an incentive to bid their true value
- **Double Auction :** A double auction is a process of buying and selling goods with multiple sellers and multiple buyers. Potential buyers submit their bids and potential sellers submit their ask prices to the market institution, and then the market institution chooses some price p that clears the market : all the sellers who asked less than p sell and all buyers who bid more than p buy at this price p. Buyers and sellers that bid or ask for exactly p are also included.
- Eg : stock exchange