ICT Applications in the Health Industry

Information and Communication Technology (ICT) is transforming healthcare by improving how medical services are delivered, recorded, and managed. Below are two detailed real-world examples:

1. Electronic Health Records (EHRs)

- What is it?

Electronic Health Records (EHRs) are digital versions of a patient's paper chart. They store comprehensive health information in one place — accessible by authorized doctors, nurses, and hospital staff.

- How it works:

  - Patient data (diagnoses, allergies, medical history, lab reports, etc.) is entered into a central database.
  - Authorized professionals can update or retrieve this data at any time, from any connected location.
  - Alerts, reminders, and warnings can be generated based on patient data.

- Example:

Mayo Clinic in the U.S. uses an EHR system called EPIC. It allows doctors to:

  - View real-time updates to a patient's treatment plan.
  - Share information with specialists in different cities.
  - Reduce the risk of medication errors through alerts.

- Benefits:

  - Faster and more accurate diagnosis.
  - Easy access to patient history, reducing repeated tests.
  - Enhanced coordination between different departments.

- Challenges:

  - High setup and maintenance cost.
  - Risk of hacking and data leaks if not secured properly.

2. Telemedicine (Remote Medical Consultations)

◆ What is it?

Telemedicine uses ICT tools like video calls, mobile apps, and remote monitoring devices to provide medical services at a distance.

◆ How it works:

- Patients book an appointment via a mobile app or website.
- They consult doctors using video conferencing tools.
- Prescriptions and lab orders are sent digitally.

◆ Example:

Sehat Kahani is a Pakistani telemedicine platform connecting patients in remote areas with female doctors via mobile apps. It:

- Offers 24/7 video consultations.
- Provides e-prescriptions and lab services.
- Reaches patients in villages where doctors are not available.

◆ Benefits:

- Saves travel time and cost.
- Helps patients in rural or remote locations.
- Reduces hospital crowding.

◆ Challenges:

- Requires good internet access.
- Some cases still need physical examination.

ICT Applications in Banking

ICT is the backbone of modern banking, enabling fast, secure, and convenient financial services. Let's look at two detailed examples:

1. Mobile and Online Banking

◆ What is it?

Online and mobile banking let customers access their accounts using a smartphone or computer without visiting a branch.

- ◆ How it works:

  - Banks create secure websites or apps.
  - Customers log in to check balances, transfer money, or pay bills.
  - Transactions are encrypted for security.

- ◆ Example:

  - HBL Mobile App (Habib Bank Limited, Pakistan) offers:
  - Balance inquiry, utility bill payments, and mobile top-up.
  - Funds transfer to other banks through IBFT (Inter-Bank Fund Transfer).
  - Biometric login for security.

- ◆ Benefits:

  - 24/7 access to banking services.
  - Reduces queues at physical branches.
  - Promotes digital literacy and convenience.

- ◆ Challenges:

  - Risk of online fraud and phishing.
  - Users need internet access and smartphone knowledge.

2. ATM (Automated Teller Machine) Systems

- ◆ What is it?

ATMs are electronic machines that allow customers to perform basic banking tasks without interacting with bank staff.

- ◆ How it works:

  - Customers insert their ATM card and enter a secure PIN.
  - The system communicates with the bank's server to process requests (withdrawals, balance inquiry, etc.).
  - Cash is dispensed or printed based on the request.

MCB Bank in Pakistan operates thousands of ATMs that support:

- Cash withdrawal
- Mini statements
- Bill payments and fund transfers

♦ Benefits:

- Available 24/7 in most urban areas.
- Reduces workload on bank staff.
- Allows customers to access money anytime.

♦ Challenges:

- Machine breakdown or cash unavailability.
- Card skimming or PIN theft risks.

ICT Applications in Expert Systems

Expert Systems are AI-powered programs designed to simulate the decision-making ability of a human expert. These systems are widely used in fields such as medicine, chemistry, law, and finance.

1. MYCIN – Medical Diagnosis Expert System

♦ What is it?

MYCIN is an early expert system developed in the 1970s at Stanford University. It was designed to help doctors diagnose bacterial infections and recommend appropriate antibiotics.

♦ How it works:

- A doctor enters a patient's symptoms, medical history, and lab test results.
- MYCIN uses a rule-based knowledge base (over 450 rules).
- It applies IF-THEN logic to evaluate the data and suggest a diagnosis and treatment.
- It also explains the reasoning behind its suggestions.

♦ Example:

Suppose a patient has a high fever, low white blood cell count, and has recently had surgery. MYCIN might analyze these details and suggest the likelihood of a staphylococcus infection, recommending penicillin G with a specific dosage.

◆ Benefits:

- Helps doctors make quick and accurate decisions.
- Reduces diagnostic errors, especially for less experienced physicians.
- Offers explanations for better understanding and training.

◆ Challenges:

- Was never used in real hospitals due to legal and liability concerns.
- Needed regular updates to keep up with new diseases and treatments.
- Could not handle unusual or complex cases not covered in its rules.

2. DENDRAL – Chemical Structure Analysis Expert System

◆ What is it?

DENDRAL is an expert system developed to assist chemists in identifying the molecular structure of chemical compounds using mass spectrometry data.

◆ How it works:

- The user inputs experimental data, such as the molecular weight and chemical fragments.
- DENDRAL compares the data against its knowledge of chemical structures and rules.
- It suggests a list of likely molecular structures that match the given data.

◆ Example:

A chemist provides mass spectrometry data from an unknown compound. DENDRAL analyzes the data and suggests that the compound is likely a type of alcohol based on the observed chemical fragments.

◆ Benefits:

- Saves time and effort in laboratory analysis.
- Increases accuracy in drug discovery and organic chemistry.
- Pioneered the use of AI in scientific research.

- Challenges:

  - Limited to specific fields like organic chemistry.
  - Required structured input and detailed data.
  - Not easily adaptable to entirely new domains without retraining.

ICT Applications in Digital Currencies

Digital Currencies are monetary values stored and exchanged electronically. These include decentralized cryptocurrencies and centralized government-issued currencies.

1. Bitcoin – Decentralized Cryptocurrency

- What is it?

Bitcoin is the world's first decentralized cryptocurrency, introduced in 2009. It allows peer-to-peer transactions without needing a central authority like a bank or government.

- How it works:

  - Users store Bitcoins in digital wallets and use public/private keys to send or receive them.
  - Transactions are recorded on a decentralized ledger called the blockchain.
  - Miners verify each transaction using computers and are rewarded with newly created Bitcoins.

- Example:

A user in Pakistan can send Bitcoin to someone in the UK without involving a bank. The transaction is verified and recorded on the blockchain in a few minutes.

- Benefits:

  - Fast and low-cost international transfers.
  - Not controlled by any government or institution.
  - Blockchain ensures transparency and data integrity.

- Challenges:

  - High volatility — prices can change rapidly.
  - Used in illegal transactions due to anonymity.
  - Mining consumes a lot of energy and computing power.

2. e-CNY – China's Central Bank Digital Currency (CBDC)

◆ What is it?

The Digital Yuan (e-CNY) is a government-issued digital currency by the People's Bank of China. It is a digital version of cash designed to be legal tender for everyday use.

◆ How it works:

- Citizens use a mobile app or digital wallet to access e-CNY.
- Payments can be made in shops, online platforms, or even person-to-person using QR codes.
- Unlike Bitcoin, it is centrally monitored and controlled by the Chinese government.

◆ Example:

In a pilot program in Shenzhen, people received e-CNY in digital wallets and used it to buy groceries and pay utility bills at participating stores using just a smartphone and QR code.

◆ Benefits:

- Reduces the use of paper cash, promoting digital payments.
- Helps the government monitor and control financial crimes.
- Provides fast, secure, and traceable transactions.

◆ Challenges:

- Raises privacy concerns due to state monitoring.
- Adoption is slow outside of government programs.
- May limit the use of decentralized cryptocurrencies in the country.