Department of Electrical, Electronics and Computer Systems College of Engineering & Technology University of Sargodha

Assignment #2: ICT in Health and Well-bieng

Subject: Introduction to ICT

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Subject: Applications of ICT (CE-1101)

Title: ICT in Health and Well-being

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(Q. #01) Analysis of Digital Health and Fitness Tracking Ecosystems

Health in ICT broadly refers to all digital tools and applications used to manage, save, transmit, and retrieve health information.

In current healthcare systems, this ranges from electronic health records (EHRs) to large-scale hospital management systems and remote consultations.

The growing dependence on these technologies stems from the need to improve clinical quality while expanding access and lowering overall healthcare costs.

1. Google Fit:

Google Fit serves as an activity-centered journal, tracking basic metrics as well as location data. It can log nutrition and hydration if connected to compatible third-party apps like Lifesum. The platform balances simple user interface with detailed tracking, especially for sleep metrics, which rely heavily on data from these external apps.

> **Features:**

- Heart Points & Move Minutes: Focuses on minutes of activity
- Broad Android/Wear OS Compatibility.
- Can measure heart rate and respiratory rate using the phone camera and Bands.

> **Advantages:**

- **Cross-Platform Flexibility:** Google Fit offers a flexible cross-platform experience compatible with Android and limited iOS devices.
- The interface is user-friendly and focused on activity tracking.
- Google Fit collaborated with the World Health Organization **(WHO)** to develop Heart points, an activity goal based on WHO's global recommendations.

> ➢ **Limitations:**

- Google Fit depends on external apps and sensors for detailed health metrics beyond basic step counting.
- Its data visualization is less comprehensive, lacking the rich graphs and detailed timelines.
- Not all third-party fitness apps can sync data with Google Fit.

Figure 1: Showing Google fit Ecosystem

2. Apple Health:

Apple Health is a comprehensive health data repository that collects information from the iPhone, Apple Watch, and third-party devices. It analyzes key health metrics such as mobility and walking distances, and users can set features for sleep, headphone audio, and medication schedules. Additionally, it allows manual data entry and can import digital health records, providing a holistic view of health data.

> ➢ **Features:**

- A visual, daily goal system driven primarily by the Apple Watch and iPhone sensors.
- Gathers all health data (from iPhone, Apple Watch,) into a single location on the iPhone.
- Allows users to download and view medical records from supported healthcare providers.

> ➢ **Advantages:**

- Apple Health benefits from **seamless integration** into the iOS operating system
- ensuring efficient operation with low battery impact.
- Its data model is underpinned by robust iOS **privacy** standards, providing high-level, native privacy controls.
- Furthermore, Apple devices offer the highest accuracy for critical biometric measurements, specifically heart rate, showing **86.31% accuracy.**

> ➢ **Limitations:**

- The experience is exclusive to users operating within the **Apple ecosystem**, limiting its application in different device environments.
- **Battery Life:** Compared to traditional watches that last for years, the Apple Watch requires daily charging and care.
- Measurements for energy (calories burned) can be **overestimated** or variable across different conditions.

Figure 2: Apple health showing detailed Metrics

3. Fitbit:

Fitbit's ecosystem is known for its detailed metrics, offering comprehensive data on sleep patterns, heart rate, and exercise logs. Google Cloud's Device Connect for Fitbit facilitates integration for clinical and research purposes, providing access to real-world patient data that enhances outcome understanding and care team efficiency.

➢ **Features:**
- Tracks time spent in fat burn, cardio, or peak heart rate zones, helping users meet weekly activity goals.
- Broad Robust Wearable Ecosystem & Coach Offers a wide range of dedicated trackers/smartwatches.
- Provides detailed Sleep Scores, tracks sleep stages.

➢ **Advantages:**

- Fitbit offers exceptionally granular metrics, including detailed sleep analysis and heart rate variability.
- Its established data collection architecture enabled by integration through Google Cloud's Device Connect.

- Fitbit devices have also demonstrated strong, though secondary, heart rate accuracy (73.56%).

➤ **Limitations:**

- Fitbit devices are generally unlikely to provide accurate measures of energy expenditure.

- Synchronization issues can result in data loss, with some users experiencing significant periods of missing data.

- They may not count steps during activities where the wrist doesn't move.

Figure 3: Fitbit Ecosystem with metrics

(Q. #02: Telemedicine) Comparison of Telemedicine and Online Health Consultation Platforms .

The three selected platforms—OLADOC, Marham, and Sehat Kahani—demonstrate distinct operational and economic models tailored to the Pakistani market.

1. OLADOC:

Oladoc is often considered the market leader in Pakistan's digital healthcare space, focusing on connecting urban patients with private specialists.

➢ **Features:**

- **Doctor Booking**: Allows users to find and book in-person or video appointments with over 25,000+ PMC-verified doctors'
- Offers to consult a General Physician (**GP**) or specialist without a long waiting time.
- **Lab Tests & Diagnostics** Users can book lab tests with home sampling services from major labs (e.g., Chughtai) directly through the app.
- Digital Health Records and Stores prescriptions and medical history digitally for easy access.

➢ **Advantages:**

- **User Interface:** It has a highly polished, user-friendly mobile application and website that makes booking very fast.
- **Wide Network:** It boasts one of the largest networks of specialists in major cities like Lahore, Karachi, and Islamabad.
- Extensive patient **reviews** and rating systems help users choose the right doctor.

➢ **Limitations:**

- **Urban Centric:** Its primary focus is on private, urban healthcare, making it less accessible for low-income or rural populations compared to Sehat Kahani.
- Premium **Pricing:** Convenience fees and platform charges can make it slightly more expensive than direct booking.
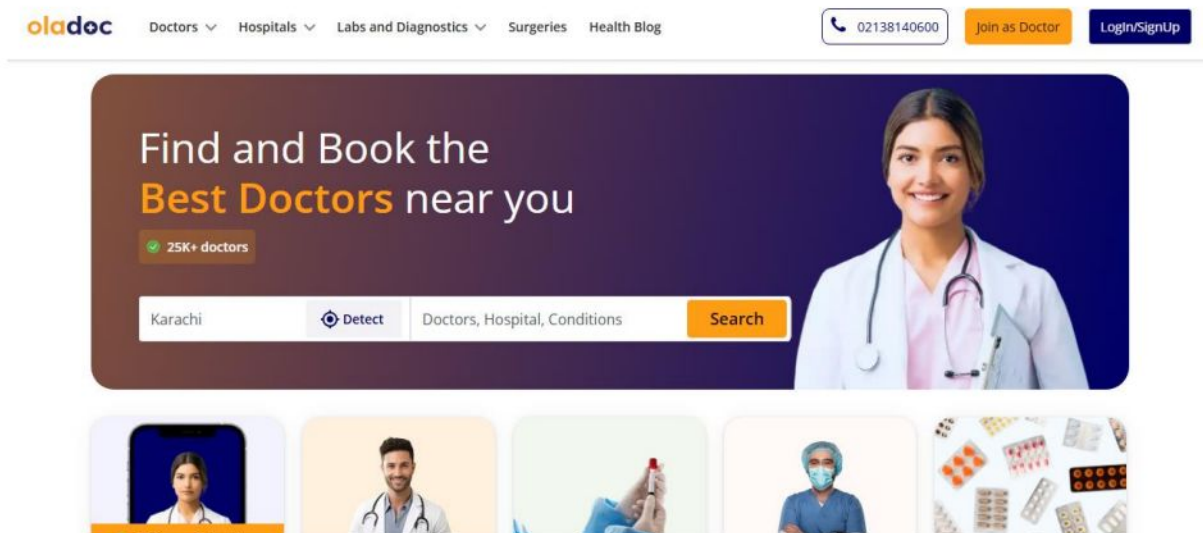
Figure 4: OlaDoc Interface

2. Marham:

Marham is a direct competitor to Oladoc and distinguishes itself through strong community engagement and content.

➢ Features:

- A unique **Q&A forum** where users can post health questions and receive answers from qualified doctors publicly.
- **Medicine Delivery**: Integrated online pharmacy services to deliver medication to the patient's doorstep.
- **Disease-wise Search:** extensive filtering options allow patients to search for doctors based on specific diseases or symptoms.

➢ Advantages:

- The platform is excellent for patients seeking medical information and second opinions through its **forum** before booking.
- Marham has a very strong **presence** in secondary cities and not just the major metropolises.
- **Integrated Ecosystem:** Offers a complete loop of consultation, medicine, and lab tests.

➢ Limitations:

- Users occasionally report **glitches** or slower performance on the app.

- **Data Overload**: The immense amount of content (blogs/forums) can sometimes make the simple act of booking a doctor feel cluttered.
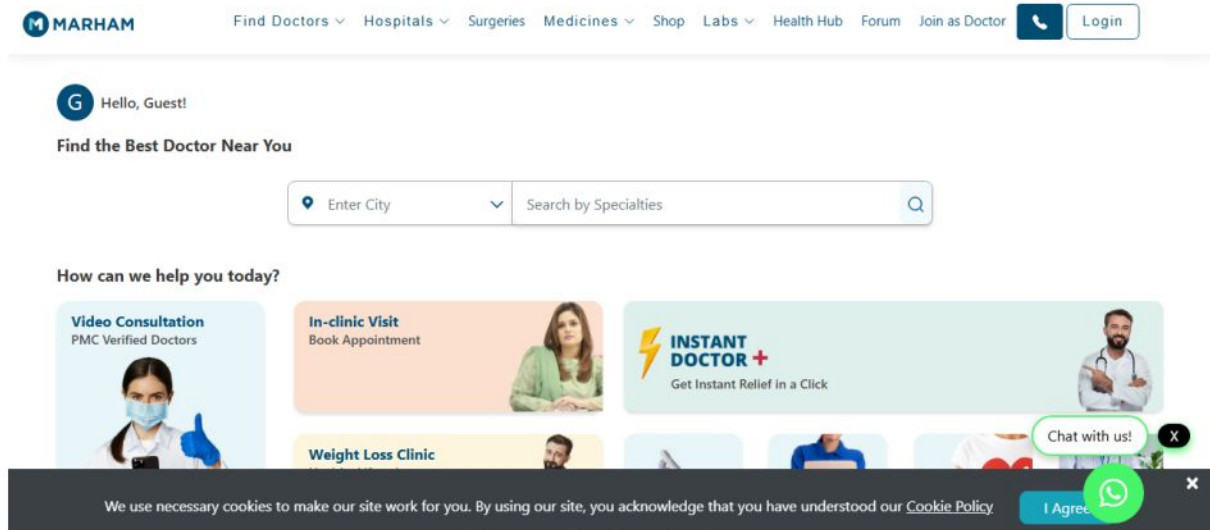

Figure 5: Marham Interface

3. Sehat Kahani

Sehat Kahani operates on a unique social-impact business model, focusing on female doctors and underserved communities.

> ## Features:

- **E-Health** Clinics: A network of physical clinics in rural areas where a nurse connects patients to online doctors via video link.
- **Corporate Wellness**: A dedicated app module for corporate employees to get cashless OPD and mental health support.
- **60-Second** Connection: Promises connection to a general physician within one minute.

> ## Advantages:

- **Social Impact**: It bridges the gap for rural patients who cannot travel to cities, making it the most "inclusive" platform.
- **Affordability:** Offers significantly lower consultation rates for general physicians compared to private specialists on Oladoc or Marham.
- **Mental Health**: Has a strong emphasis on online psychological counseling.

> ## Limitations:

- While excellent for primary care it may have **fewer** high-end surgical specialists available.

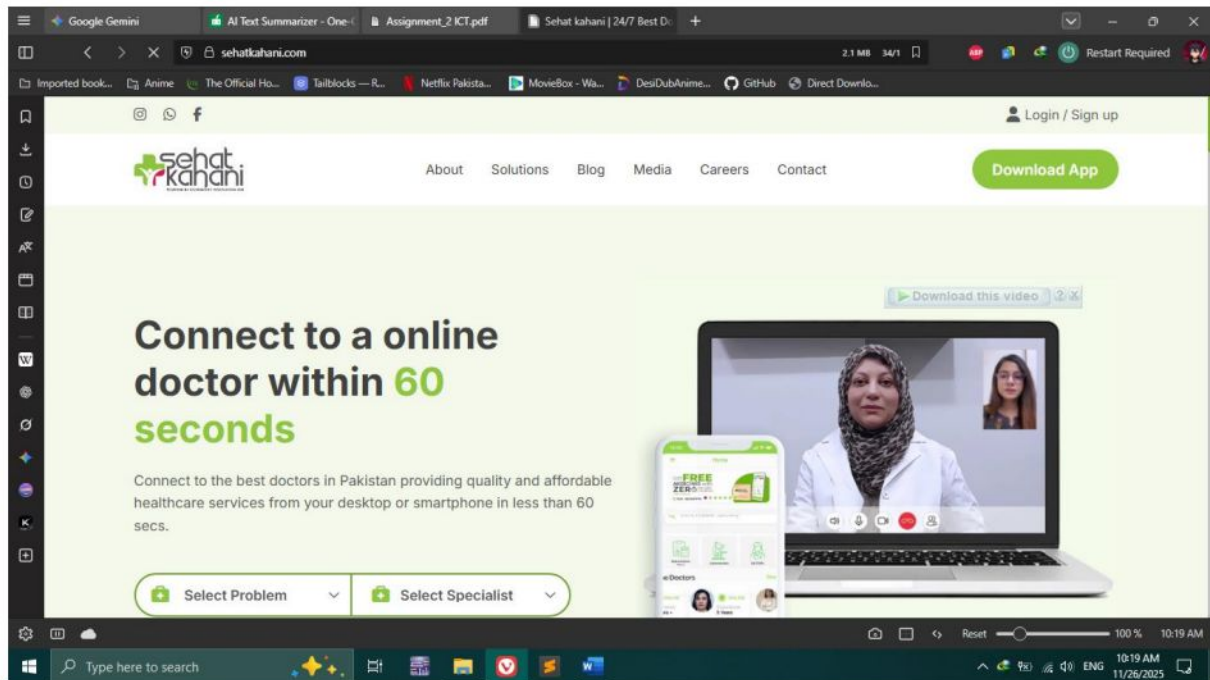- The **E-Clinic** model relies heavily on the physical presence of a nurse intermediary, which is resource-intensive.

Figure 6: Sehat Kahani Interface