

A Study on mHealth Innovations through the Lens of Patent Analysis

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Received: 23rd October 2022; accepted: 26th October 2022

Mobile health also referred to as mHealth is a broader term that includes mobile computing, medical sensor, communication technologies, and other wireless technologies associated with healthcare. Mobile health apps are becoming more popular due to their varied applications and have the potential to greatly improve the healthcare segment in any country. In this context, the present study attempts to provide a comprehensive picture of innovation trends in mHealth domain through patent landscape analysis. Further, it attempts to identify the major challenges with respect to patenting and protecting innovation in India. The analysis shows that there is an upward trend in patenting since 2002 onwards, and in addition to big private entities, start-ups and academic institutions are also having a major contribution to innovations in mHealth sector. However, there are inherent challenges in patenting an ICT technology which was also evident in our study with respect to selected mHealth app patents. A concerted effort in enhancing IPR capture as well as appropriate support mechanism is the need of the hour to promote and effectively implement mHealth in the country.

Keywords: Mobile Healthcare, mHealth, Health Technology, Digital Health, Wearable Sensor, Smart Health Monitoring

Health is "a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity".¹ Everyone's life now revolves on technology in some way and widespread usage of mobile technology in healthcare is currently viewed as inevitable due to accessibility and rising expenses associated with health monitoring.² After telemedicine, telehealth, and e-health, mHealth has emerged as the fourth ICT for healthcare pillar. Mobile health also referred as mHealth is a broader term that includes mobile computing, medical sensor, and communication technologies, and other wireless technologies associated with healthcare. The term mHealth was first coined by Robert S. H. Istepanian in 2003.³ The mHealth is a smart phone-focused healthcare technology enabler that has the ability to use these technologies to deliver better healthcare services and outcomes.⁴ A very simplified illustration on how the perception on the use of mobile applications in health would be as follows:

Healthcare Delivery Service + Mobile (Smart) Phone = mHealth

By exploiting the data offered by technologies like wearables, IoT devices, and mobile phones, mHealth strives to enhance our health and wellbeing (Fig.1). With the use of mHealth, healthcare professionals and patients can communicate more effectively.

The mHealth can also offer interesting games or challenges to inspire or motivate people to make improvements to their health.

mHealth - A Technology in Digital HealthCare

A wide and multidisciplinary notion called "digital health" or "digital healthcare" comprises concepts where technology and healthcare intersect. The broader umbrella of digital health encompasses fields like wearable technology, telehealth and telemedicine, personalized medicine and mHealth. According to WHO, digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable. It should be developed with principles of transparency, accessibility, scalability, replicability, interoperability, privacy, security and confidentiality.⁶

In 2011, the WHO defined mHealth as medical and public practice supported by mobile devices such as mobile phones, patients monitoring devices, personal digital assistants (PDA's) and other wireless devices. Mobile health or mHealth is the use of mobile, wireless technologies to connect, communicate and promote these computing with the aim of supporting individual's health and well-being.⁶

As a popular and emerging branch of Digital HealthCare system, mHealth is not only recognized by WHO, but the federal drug regulatory authorities also acknowledge the importance of mHealth. The US

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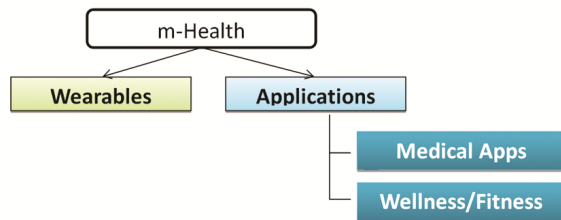


Fig.1 — mHealth - A technology in digital healthcare
(Source: 2021 IEEE International Conference on Big Data and Smart Computing, BigComp 2021)⁵

Food and Drug Administration (FDA) defined a mobile medical app as a software function deployed on a mobile platform that meets the definition of a medical device.⁷ Numerous apps have been designed for use by health professionals, and a small number of them have received regulatory approval as “software as a medical device” (SaMD) intended to treat, diagnose, cure, mitigate, or prevent disease.⁶

The global mHealth market size was valued at USD 50.7 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 11.0% from 2022 to 2030.⁸ Broadly, the global mHealth apps market is segmented as per their uses or services such as:

- 1) By App Type: Disease and Treatment Management, Wellness Management, Others
- 2) By Connected Medical Devices: Heart Rate Meters, Wearable Fitness Sensor Device, Blood Pressure Monitors, Pulse Oximeters, Others
- 3) By Service: Monitoring Services, Fitness Solutions, Diagnostic Services, Prevention Services, Others

The mHealth segment in itself is highly innovative. Further, the adoption of artificial intelligence (AI) and 5G are shaping the mHealth apps market. Artificial intelligence is human intelligence that is processed by machines such as computers and focuses on learning, reasoning, and self-correction and AI is adopting 5G to improve customer experiences. The advancement in (AI) and 5G is introducing new opportunities for service providers. Artificial intelligence plays a major role to solve network complexities. Companies are launching AI platforms to enhance customer experiences. For example, in January 2020, Babylon Health, a UK-based digital health service provider announced that they are developing an AI-integrated health application to serve 300,000 people in England. The countries covered in the mHealth apps market report are Australia, Brazil, China, France, Germany, India, Indonesia, Japan, Russia, South Korea, UK, USA.⁹

mHealth in India

With diverse patient base and high uses of mobile devices, India has the potential to leverage the benefits of mHealth. As per the IBEF 2021 report, wearables such as glucose monitors, exercise trackers and medical wearables are increasingly used in India.¹⁰ The Ayushman Bharat Digital Mission announced in 2021 will enable the creation of digital health ID. It is expected that it can also foster the ease of use of the wearables in different parts of the healthcare system.¹¹

In 2020, the CDSCO (Central Drugs Standard Control Organization), India approved three wrist wearable devices namely Smart Vital, Vital 3.0 and Vital ECG. This marks an important development in the Indian regulatory approval domain as they were recognized under the Medical Device Regulation.¹² As India starts recording increase in market growth in wearables, it is expected that there will be greater competition and more innovations in this area. Both the domestic and foreign companies are trying to innovate in different aspects of mHealth and the market is populated by newer apps frequently. Irrespective of technologies, innovation protection through patents has always helped the inventors to protect and commercialize their technologies. Also, patent is considered as an indicator of innovation. To this end, this paper focuses on analyzing the innovation trends in mHealth segment through patent landscape studies. Here, we have focused on global landscape as well as India specific innovations to understand the development and technology landscape in mHealth domain. Also, an attempt has been made to understand the challenges in patenting mHealth technologies in India with the help of examples.

The study involves patent analysis by task identification like setting goal, the scope and concept of analysis. It involves building a portfolio of patents by searching and filtering the most relevant ones. Patent classification codes worked as a filter in the search process. In order to perform a serious research, a preferred methodology was a combination of both classification and keyword search. The search was initiated by using relevant keywords including structural and functional aspect of mobile healthcare, mHealthcare, and related queries such as mobile-application or mobilephone or android or smartphone or telephone or telehealth or phone or mobile or mobile-health or m-health or app or tele-application or wireless web device or personal communication apparatus or remote-communication or remote-monitoring including others. At the end, most relevant

keywords and classification codes were selected to prepare the final dataset for analysis. The IPC/CPC codes included in the search are A61B-005 (Measuring for diagnostic purposes; identification of persons), G16H (Healthcare informatics, i.e., information and communication technology [ICT] specially adapted for the handling or processing of medical or healthcare data), and H04W (Services specially adapted for wireless communication networks; Facilities therefore in medical technology). These IPCs were shortlisted based on their relevance to related applications.

For the purpose of this study Questel Orbit Database was used. After performing the initial search, a resultant patent data set was obtained. An analysis of each patent and patents family were performed based on patent characteristics to ascertain the relevance of the patent. Then, with relevant set of result, patent map is obtained and interpreted. In order to analyze patents' data, different methodologies like text-mining, network analysis, citation analysis and index analysis is applied. PRISMA guidelines were followed in screening the records for analysis. Documents were extracted till 25 September 2022. The language of the documents selected was English only. Search flow based on PRISMA guidelines is depicted in Fig. 2.

Global Perspective on mHealth Patents

The study was carried out with the combination of keywords and most relevant classification (A61B/G16H) in medical technology domain without time restriction in Questel Orbit Intelligence Database on 25th September 2022. The search resulted in a total of 53678 numbers of patent applications, of which 42.5% (n=22808) were granted patents and 20.1% (n=10776) were pending, very few are revoked

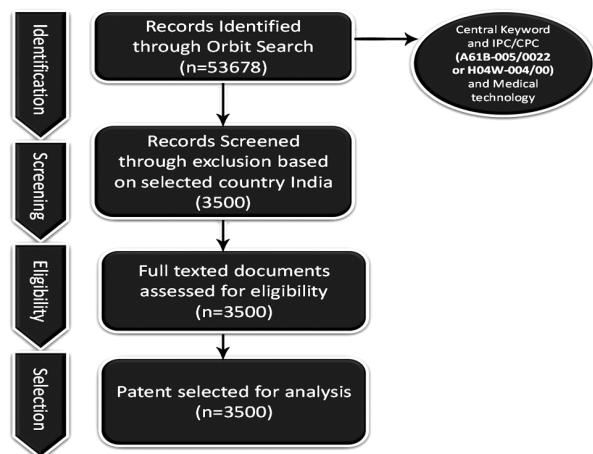


Fig. 2 — Search flow chart based on PRISMA

(8.6%), or expired (6.0%) or lapsed (22.8%) patents. The study revealed that only around 4% of all patent applications are owned by top ten major players globally.

The Chronological Trend in Patenting of mHealth Technology

The patent study shows that the patent filing with respect to mHealth started in the year 2002 with around 815 applications filed globally. Subsequently, till 2020 there has been an upward trend in filing of applications wherein, the highest number of patents filed is observed between 2016 and 2020; with the maximum number of patents (5042) filed in 2020. The increasing trend may be related to the increase in mobile users across countries. The impact of COVID 19 may have contributed to the high rise in patent filing during 2020. Despite the fact that mHealth technology has existed since 2002, individuals, startups and academic institutions marked their visible presence only after 2016. Figure 3 depicts global patent filing trends.

The Geographical Trend in Patent Filing of mHealth Technologies

An analysis with respect to filing from different countries/regions showed a clear leadership by China with 16929 patent applications, followed by United states with 13828 patent applications, and the European countries are the third-largest patent application holder in this domain with 10311 applications. Among the top ten applicant countries, while China covers 22.08% of total patent applications, India covers only 5.56% of total patent application and ranks 9th globally. The dominant presence of China suggests that it is very proactive in innovating in mHealth segment. The large population and acceptability for mobile health technologies may have a positive stimulus towards innovations in this sector. China also ranks second in terms of revenue generated by mHealth following US. Figure 4 illustrates the top 10 applicant countries.

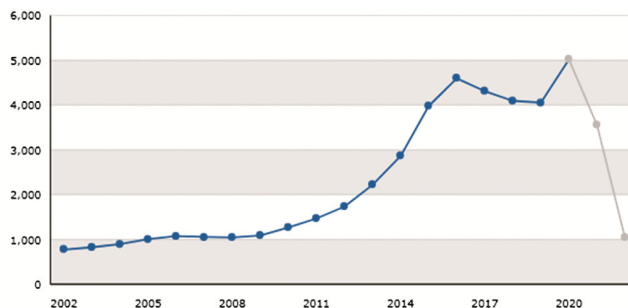


Fig. 3 — Global patent filing trend in mhealth over the last 20 years

Key Assignees of mHealth Technologies

The assignee analysis with respect to mHealth domain shows that many big MNCs are the top patent applicants. Interestingly, the top 10 assignees hold only 4% of the total applications filed in this sector. Companies like Phillips, Samsung, Covidien, and Medtronic are among of the leading assignees for patents in the mHealth domains and Philips has the maximum number of applications (Fig. 5). Also, the individual patent analysis suggest that majority of the applications are in the domain of medical technology related to the apps. It is interesting to see that the mHealth segment includes the presence of many start-ups, academic institutions and developing enterprises, and the big established companies are in the race for innovation. It depicts the demand for m-health segment and need for newer and affordable innovations.

Technology Domain

The organization of the patent families as per core technology domain reveals that majority of the patents

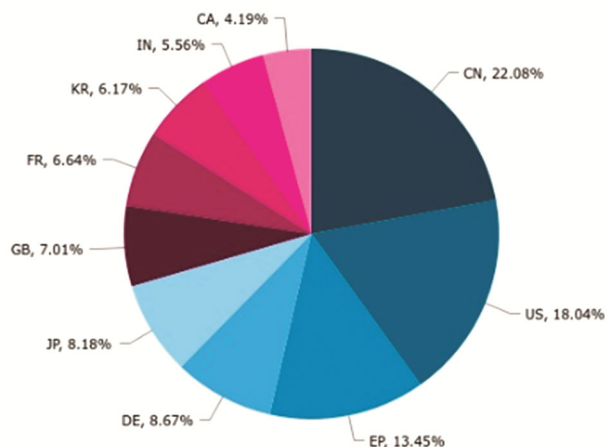


Fig. 4 — Global geographical patent filing trend (India ranked 9th)

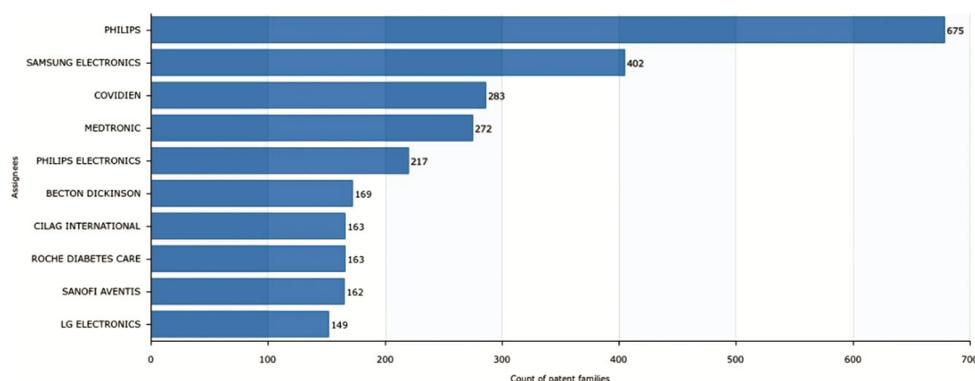


Fig. 5 — Top ten key players worldwide

are related to the area of medical technologies (53678 patent families), secondly for computer technology (7614 patent families) followed by measurement (5771 patent families), telecommunications (5720 patent families) and control (4797 patent families) segment. Increase in the health consciousness of general population and tendency to take measure of different physical and metabolic parameters may suggest the significance of greater number of patents in medical technology segment and its association with computer technology and measurement domain.

The mHealthcare Apps in India

Patent Analysis from Indian Perspective

In India, a number of mHealth initiatives have started in response to the pandemic to help raise public awareness about COVID and implement countermeasures to curb its spread. Another major reason for the growth of this market is the increase in the number of smartphone users and internet accessibility in India. Also, the increasing incidence of chronic diseases is significantly contributing to the growth of the mobile healthcare app market.⁹ Fitness tracking has been an activity that is growing in the urban population of India among the people in different segments.

A patent search (keyword and classification based search) on mHealth resulted in 53568 patent families globally. The patent data set was then filtered specifically for India as the publication country and it resulted in 3500 patent data set, which is then utilized for various analysis. In India, out of 3500 patent families filed, it is observed 95.5% (3343) applications are alive and only 4.5% (157) applications are in dead state. This very high proportion of alive in-force patents indicates that the mHealth app sector in India is young and attractive sector. There is a lot of potential to enter in to

the market, the development and launch of a new process or product. From the legal status of alive patent applications, it is further observed that 48.2% (n= 1688) are granted and 47.2% (n= 1655) are pending (applications that are in the process of different grant stages at patent office), very few are revoked (n=78), expired (n=25) and lapsed (n=54) patents as shown in Fig. 6.

The Chronological distribution of mHealth app patent applications in India shows (Fig. 7) that the filing activity started from 2002, and is steadily increasing. The patent data for 2021 and 2022 is considered as a grey area because it reflects only published applications and do not include applications in 18 months' pre-grant publication period of patent applications. Most of the patent applications filed in India derived their priority mainly from PCT phase applications (1986 patent families) followed by India (1433 patent families), USA (1384 patent families), and Europe (657 patent families) applications. This reveals that the major patent applications gained national entry into India through the PCT phase. On an average there are more than seven patents in a given patent family. These large families imply greater geographical protection and major investment by patent applicants in this area.

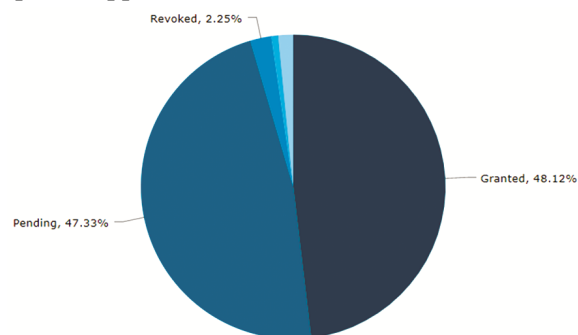


Fig. 6 — Legal state of mhealthcare apps in India

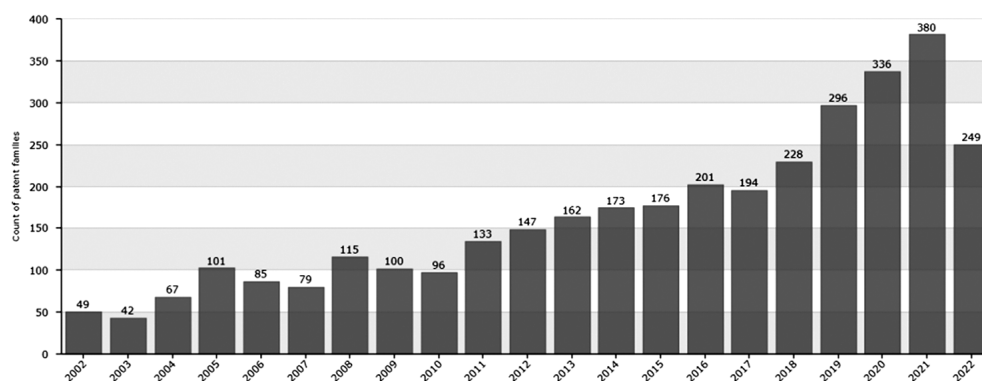


Fig. 7 — Chronological distribution of mhealth patent applications in India

Technology Domain

The organization of the patent families as per core technology domain reveals that majority of the patents belong to the area of medical technologies (3500 patent families), computer technology (984 patent families) followed by measurement (642 patent families), Telecommunications (513 patent families) and control (501 patent families). It also identified other potential applications such as multiple use or new use of already patented inventions in the field of mHealth apps such as audio visual technology (213 patent families), textile industry (25 patent families), furniture (183 patent families) (Fig. 8).

Concept Clusters

Concept clusters, also referred to as industry or innovation clusters. A concept cluster represents a concentration of interconnected companies and institutions in a particular field. The distribution of the main concepts contained in the mHealth app in India is shown in the Fig. 9. It is evident from the Fig. 9 that the patent applications are filed mainly on smartphones, patient monitoring, pulse rate, heartbeat, glucose level measuring, wearable sensors areas. These clusters are helpful in understanding the major innovation domains where many companies or individuals are participating and have a potential commercialization aspect.

Top Assignees

The analysis for top assignees with respect to 3500 patented inventions reveals that of the total applications filed around 19% owned by top 10 players. Philips, the top assignee globally is also the top applicant in India with 415 patent applications in the mHealth field. After Philips, Cilag International and Lovely professional university (LPU) are the top assignee in India. Interestingly, academic institutes

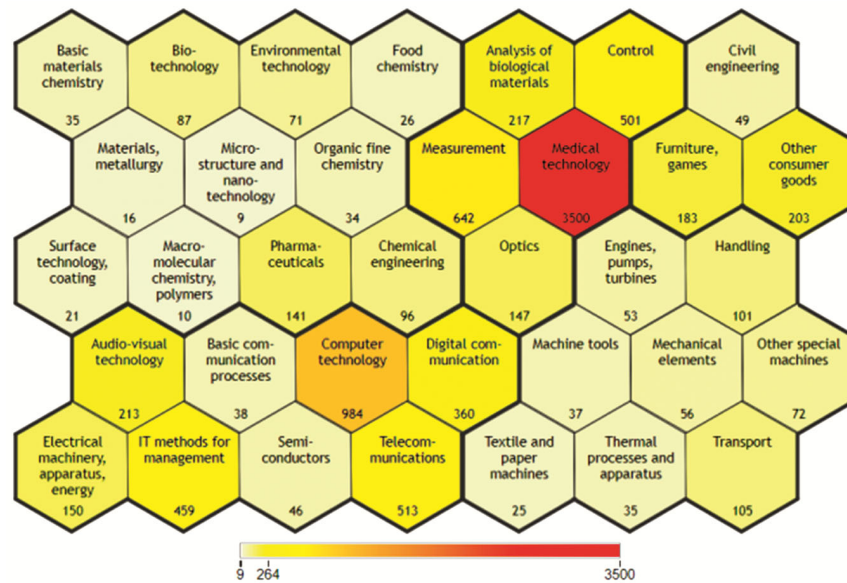


Fig. 8 — Technology landscape of mHealth patents in India



Fig. 9 — Concept cluster

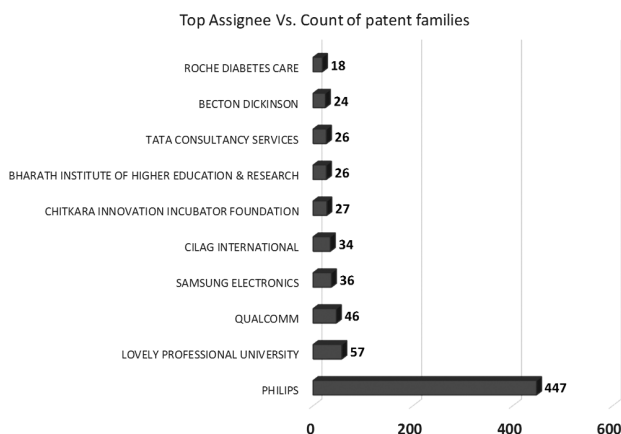


Fig 10 — Top Assignees filing patent applications on mHealth in India

like LPU and Bharath institute of higher education and research are active in filing in this mHealth area in India apart from other multinational companies. In addition to above it is interesting to observe that many academic institutions and start-ups are also filing in

mHealth domain. High demand of the technology, low investment, ease of R&D and rapid turnover might have contributed to the presence of many academic institutions and small companies in this sector.

Patent Filing Trends and Technology Landscape

A technology landscape analysis for the top assignee was performed to understand the major focus of the companies/institutes. Figure 11 represents the filing by different assignees as per the technical domains. For example; the major focus of Philips is on wireless communication in patient monitoring and treatment in India, Lovely professional university is filing in the area of energy efficient smart medical systems. Chitkara innovation incubator foundation focus is on health monitoring systems. Bharath institute of higher education & research has focus on microcontrollers and sensors in mHealth apps.

Further analysis of patents for various IPC and CPC also confirms the above landscape. Understanding where patents are being filed for a particular IPC/CPC class (research area) will enable researchers and business firms to prepare effective strategies to combat competition. According to the data given in Table 1, most of the Indian patent application are filed belong to the IPC Class A61B-005/00 (Measuring for diagnostic purposes and Identification of persons) followed by A61B-005/11 (Measuring movement of the entire body or parts) is at the second position among the prominent ten IPCs.

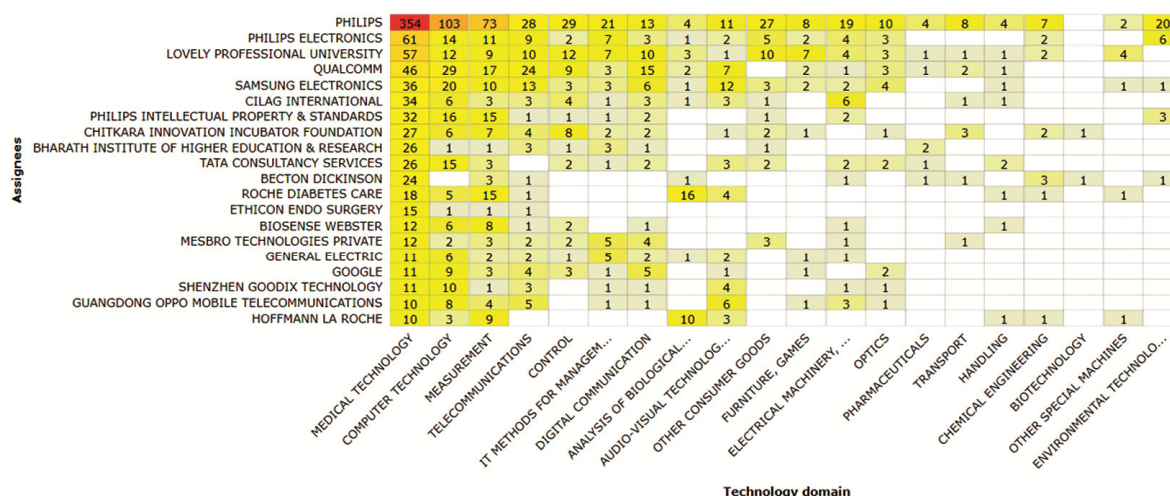


Fig. 11 — Key players by technical domain

Table 1 — Spread of patents as per IPC class

Percent	IPC codes	Definition
56.87%	A61B-005/00	Measuring for diagnostic purposes
13.60%	A61B-005/11	Measuring movement of the entire body or parts thereof, e.g. head or hand tremor or mobility of a limb
12.21%	A61B-005/0205	Simultaneously evaluating both cardiovascular conditions and different types of body conditions, e.g. heart and respiratory condition
12.21%	A61B-005/024	Measuring pulse rate or heart rate
9.11%	G06F-019/00	Electric Digital Data Processing (computer systems based on specific computational models G06N)
7.72%	G06Q-050/22	Systems or methods specially adapted for specific business sectors, e.g. utilities or tourism (healthcare informatics G16H); social work
7.10%	A61B-005/145	Measuring characteristics of blood in vivo, e.g. gas concentration, pH-value (measuring of blood pressure or blood flow A61B 5/02; non-radiation detecting or locating of foreign bodies in blood A61B 5/06)
6.33%	A61B-005/01	Measuring temperature of body parts (clinical contact thermometers G01K 13/20)
6.02%	A61B-005/1455	Measuring characteristics of body fluids or tissues, e.g. interstitial fluid, cerebral tissue : using optical sensors, e.g. spectral photometrical oximeters
6.02%	G06K-009/00	Methods or arrangements for recognising patterns

Standard Essential Patents in mHealth Segment

Patent is the exclusive right given to the patent holder to have the right to sell, mortgage or give a license to his invention. Patent plays a critical role in licensing and more generally, in the dissemination of new knowledge. The information nature of new knowledge is a peculiar property in the determination of demand for information. Patents, therefore, can play a crucial role in reducing transaction costs of licensing innovation and, more so in technology transfer. Without an exclusive or non-exclusive license backed up by patent rights, firms would not be interested in expensive development work required to transform an invention into a new product.

Interestingly, the patent analysis in the mHealth segment showed that there are many patents which

are designated as Standard Essential Patents (SEP). SEP are the patents protecting technology essential to a technical standard. Standards can be adopted worldwide, or only regionally or even nationally. It is usually in the interest of industrial players to create products that comply with standards. Products that do not follow such defined standards are generally commercial failures because consumers want their devices to conform to commonly accepted standards in society. In sum, standards today play an important role in improving the compatibility and quality of products and services in the market. The patent quality (and quantity) represents an essential input factor into the standardization system, and also supports legal certainty and a sustainable co-existence of both patent and standardization systems.

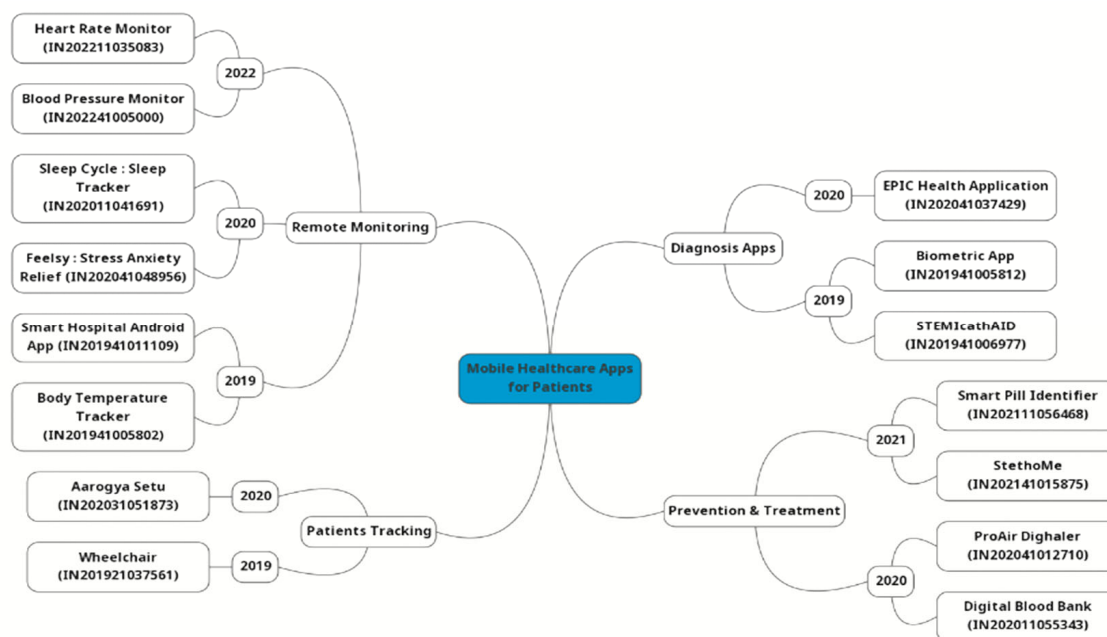


Fig. 12 — Mobile health apps available at play store

The retrieved patent data in mHealth mobile apps shows the presence of eight standard essential patents and these standards are mainly ETSI (European Telecommunication Standard Institute) (Table 2) standards. Presence of such SEPs is indicator for more licensing opportunities for the potential developers.

Patenting mHEALTH APPS- Patent prosecution challenges

In recent years many mobile health apps are available in India. In order to understand the challenges related to patenting of such apps, we have identified 15 mobile apps which were very recently released in play store for our study purpose. The related published patent applications with respect to those 15 apps were analyzed. Our study shows that patent applications were filed during the 2016-2022. Most of them were from 2019 onwards and are still pending. Interestingly, majority of applications were filed by individuals or academics and none of these were filed by top corporate companies.

In order to understand the challenges related to patenting of mHealth technologies in India we tried to analyze the First Examination Reports (FER) of the patent applications in India. The study of FERs in general showed that majority of applications got objection from the examiner based on lack of novelty or inventive-step in view of published documents in form of research articles and thesis publication. The other major objection was with respect to non-

patentable subject matters presented in the application. We found that the non patentable subject matter either falls within the scope of Section 3(k) of the Patent Act 1970, which it relates to computer program per se or Section 3(i) i.e. method of treatment. Few of the applications were objected on the basis of Section 3(n) i.e. presentation of information and Section 3(f) as they claim a device which is obtained by the mere arrangement or re-arrangement or duplication of known devices each functioning independently of one another (For example, a Smart Wheelchair, which works on Joystick or which works on mobile app or which works on Bluetooth module).

Some of them showed lack of unity of invention. For example, application claiming a wearable device or sensor, an Android app and a data monitoring system in single patent application is objected as they define three groups with separate inventions which are not linked so as to form a single general inventive concept as defined u/s 10(5) of the Patents Act, 1970.

Some of Patent application of medical technology claiming method for monitoring remotely falls within the scope of Section 3(i) of the Indian Patent Act. This eventually falls under diagnostic process which is measuring a physiological parameter to evaluate the state of health in human beings. These methods, claimed in any form, are considered to be not patentable as it attracts the provision of Section 3(i) of The Patents Act, 1970 (as amended).

Table 2 — List of standard essential patents

Publication number	Applicant/Assignee	Title	Standards
EP2789209	Capsule Technologies; Philips Healthcare Informatics*;Qualcomm; Qualcomm Labs	Telehealthwireless communication hub device and service platform system	ETSI-TS-118-101 (Functional Architecture)
EP1789940	2011 Intellectual Property Asset Trust*;Conversant Wireless Licensing*; Core Wireless Licensing; Nokia;Vincent Wireless Licensing	Enhanced pre-notification procedure for geran mbms	ETSI-TS-123-003(Digital cellular telecommunications system), ETSI-TS-123-246 (Universal Mobile Telecommunications System) ETSI-TS-136- 300 (LTE Evolved Universal Terrestrial Radio Access) ETSI-TS-136-331 (Evolved Universal Terrestrial Radio Access) ETSI-TS-144-060 (Digital cellular telecommunications system)
EP1346594	Qualcomm*	Method and apparatus for call recovery in a wireless communication system	ETSI-3GPP-TS-25-214 ETSI-3GPP- TS-38-213 (5G Physical layer procedures for control) ETSI-3GPP-TS-38-300 ETSI-3GPP-TS-38-331 (Radio interface protocol architecture) ETSI-TS-125-214 (Universal Mobile Telecommunications System; Physical layer procedures)
EP3984174	NEC*	Credential storage and selection of credentials for non-public network	ETSI-3GPP-TS-23-501 ETSI-TS-133-501 (5G; Security architecture and procedures for 5G System)
EP3846566	Beijing Xiaomi Mobile Software*	Method and apparatus for indicating and determining transmission direction of transmission unit, and storage medium	ETSI-3GPP-TS-36-211 (5G ; NR; Physical channels and modulation)ETSI-3GPP-TS-36-212 (5G ; NR; Multiplexing and channel coding) ETSI-3GPP-TS-36-213 (5G; Physical layer procedures for control)
EP3883322	Huawei*	Communication method and apparatus	ETSI-3GPP-TS-38-211 (Physical channels and modulation) ETSI-3GPP-TS-38-331 (Radio Resource Control (RRC); Protocol specification)
EP3720156	Qualcomm*	Reserved range of tmgi for receive-only mode	ETSI-3GPP-TS-23-003 ETSI-3GPP-TS-24-116
EP3874713	Samsung Electronics*	Method and apparatus for managing bundles of smart secure platform	ETSI-TS-103-465 (Smart Cards; Smart Secure Platform (SSP); Requirements Specification) ETSI-TS-103-666-2 (Smart Secure Platform)

Select Case Studies for Patent Objections

The Android App — Somn App

The application is related to an android based application, extracting information from detected characteristic signals & execute the steps involved in invention comprising receiving & extracting, but do not disclose any functional and structural limitations of the feature of the said claims. However, it represents computer program per se in sequential manner and implementation on the hardware (conventional systems) and software environment with certain protocols. So, the claims represent a set of instructions executed on a general purpose and conventional processor/computing platform without showing any technical motivation as a whole. Thus it

is not patentable u/s 3(k) of the Patents Act, 1970. It also lacked in unity of invention due to three different groups define separate invention which are not linked so as to form a single general inventive concept as defined u/s 10(5) of the Patents Act, 1970.

IRICIAL App

An intellectual app which will automatically recognize the missing person. The IRICIAL term represents the combination of iris and facial recognition. This invention covers an app for tracking and reporting of people who might be lost or missing. The objective of this invention does not require any structural or interactional changes from the system and is wholly achieved by a set of instructions. In absence of disclosure regarding any differentiating

structural features of said system, it appears that the alleged invention covers a set of instructions or computer program *per se*. Therefore, the subject matter of claims attracts the provision of clause (k) of Section 3 of The Patents Act 1970 (as amended).

MANUS App

The term MANUS means hand in Latin language. It is a bio-mechanical engrossing nano non-invasive device for tracking victim using skin temperature sensor and IoT mobile (manus) app. The proposed device is composed of GPS tracker and a Skin Temperature sensor (Biometric sensor). If the victim is in vulnerable situation, such as when body temperature reaches to a certain point the device gets activated and starts tracking the victim and transmits the live location to the registered mobile number and nearby police station or else, it is clear that the victim is in safe zone.

(i) The subject matter of the invention lacks inventive step u/s 2(1)(j) of the Act in view of D1:US20160242646A1 and

(ii) Non-patentable under the provision of clause (n and f) of Section 3 because a presentation of information is not an invention. Any manner, means or method of expressing information whether signals, symbols, diagrams or any other mode of representation is not patentable and not patentable u/s 3(n) of the Act. The mere arrangement or re-arrangement or duplication of known devices each functioning independently of one another in a known way is not an invention. A combination of old known integers may be so combined that by their working inter-relation, they produce a new process or an improved result.

Mobile App for Myocardial Infarction

A method for remotely monitoring the location of the patient cavity in the tooth and mount a nano non-invasive chip in the cavity. Then the cavity is filled with dental filling material. The invention also contains method for detection of heart attack using nano chip.

The subject matter falls within the provisions of Section 3(i) of The Patents Act, 1970 for the reasons, that it teaches about method for monitoring remotely. This eventually falls under diagnostic process which is measuring a physiological parameter to evaluate the state of health in human beings. These methods, claimed in any form, are considered to be not patentable as it attracts the provision of Section 3(i) of The Patents Act, 1970.

SELWD- Smart Electric Locomotive Wheelchair for Disabled

SELWD system consists of Arduino Uno Microcontroller, a Bluetooth module, Hub motors and motor drivers to control the movement of the wheelchair, a Joystick and Battery for powering the system wherein the Arduino Uno acts the main controlling element, which takes input from the mobile app, Bluetooth module as well as the Joystick and performs accordingly.

Claims of the invention are statutorily non-patentable under the provision of clause (k,f) of Section 3 for the reasons as they claim a device which is obtained by the mere arrangement or re-arrangement or duplication of known devices each functioning independently of one another (Wheelchair, which works on Joystick, which works on mobile app, which works on Bluetooth module) and subject matter falls within scope of clause (k) of Section (3) of the Patents Act, 1970 (as amended) because it relates to computer program *per se*.

Conclusion

It is evident that mHealth can ensure enhanced health outcomes, ample patient care and offer quality support for professional health workers. Apps are available to monitor diabetes, asthma, depression, celiac disease, blood pressure, chronic migraine, pain management, and fitness. The Indian mHealth industry is anticipated to experience aggressive IP filing and innovation trends and is poised to grow exponentially with a target market size of US\$50 billion by 2025 thanks to recent policy initiatives from the Indian government, including Startup India, Make in India, 100% Foreign Direct Investment (FDI), and others.¹³ Our study with respect to patents in mhealth segment shows that startups and research institutions are important actors in innovating in the domain. From the study it can be inferred that government has the intention to boost innovation and promote small industries and all educational institutes. A knowledge-based economy and a flourishing startup environment require a developed IPR regime, as well as the cooperation of startups, academia, and policymakers. At the same time there should be a harmonization between private sectors like telecom, insurance, pharma, wellness, IT, government, healthcare service providers like hospitals, NGO's, civil society, health technology providers (Apps developer) and users. India has the potential to excel in the mHealth domain provided the innovation can be protected effectively. There are patenting challenges owing to the critical linkage with computer technology or medical diagnostic

processes. However, the challenges can be overcome by bringing more awareness regarding the nuances in patenting and drafting techniques. No doubt, the healthcare ecosystem in India can greatly change if we can bring a conducive environment by nurturing and protecting innovation in mHealth segment by appropriate policy measures and a collective effort by all stake holders.

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