Virtual- Innovation Think Tank Certification Program, March 2021

ITTCP India , China

SIEMENS Healthineers

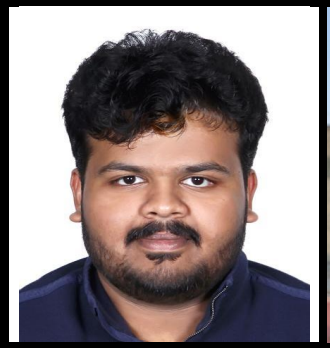
COUNTERING INFECTIOUS DISEASES

1) Digitalization
   - Problem statements:
     - Lack of Centralized Storage System
     - Lack of Proper Utilization of collected data

2) Infrastructure
   - Problem statement 1: Lack of Safety and Sterilisation
   - Problem statement 2: Meagreness in Pandemic Preparedness plans

K.S.Maanav Charan
3RD YEAR B.Tech
Mechanical Engineering
VIT, Chennai

Ackshaya Varshini K.S
3RD YEAR B.Tech
Mechanical Engineering
VIT, Chennai



Alenkar .K. Aswin
3RD YEAR B.Tech
Mechanical Engineering
VIT, Chennai

Yatharth Agarwal
2nd YEAR B.Tech
Mechanical Engineering
GLBITM, Greater Noida

Swarup Tripathy
2nd YEAR B.Tech
Electrical and Electronics Engineering
VIT, Vellore

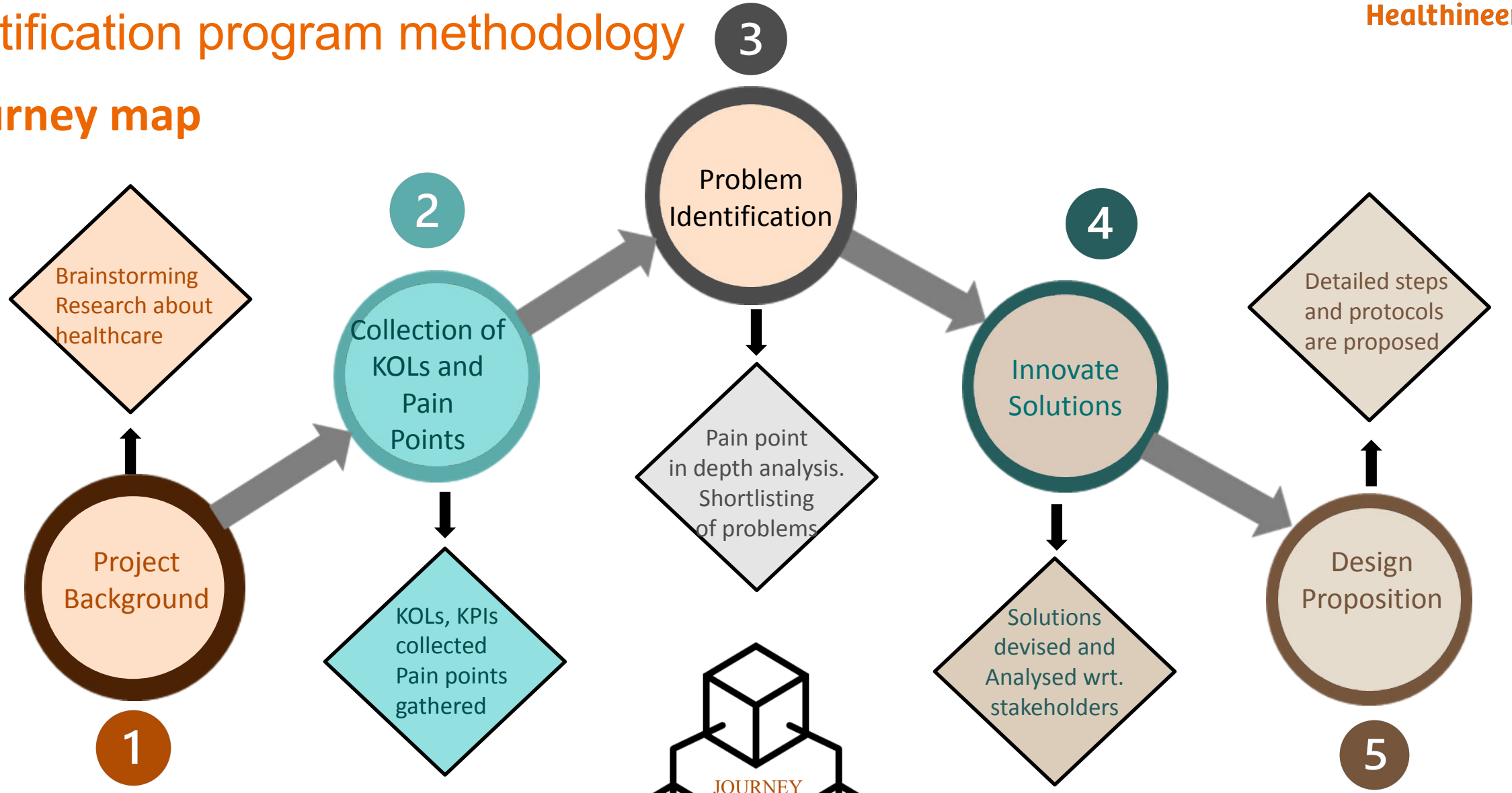
Anvit Agarwal
2nd YEAR B.Tech
Computer Science Engineering
JIIT, Noida

Innovation Think Tank
Proactively drive innovation to improve human life

Innovation Think Tank
Certification program methodology

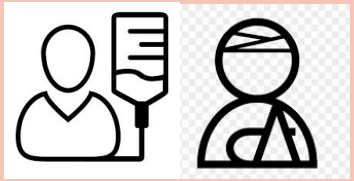
SIEMENS Healthineers

Journey map



Innovation Think Tank
Proactively drive innovation to improve human life

Stakeholders



Patients

Patients are responsible for their own health and towards controlling costs. While it would be impossible to implement a program that forced people to live healthy lifestyles, it is reasonable to assume that healthier living would lead to lower healthcare costs.

Physicians

Ensures that their patients receive adequate healthcare, but also in controlling the rising costs of healthcare. They have to find a balance between having a gatekeeper role for the insurance companies and being an advocate for the patient.

Employers/Staff

Staff play a key role in day-to-dat management of the hospital. Also, many employers offer health insurance coverage with varying deductibles and co-pays for their employees.

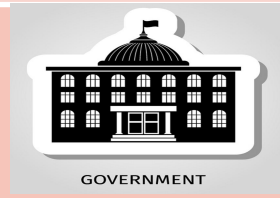
Stakeholders are those entities that are integrally involved in the healthcare system and would be substantially affected by reforms to the system. The major stakeholders in the **healthcare system** are patients, physicians, employers, insurance companies, pharmaceutical firms, and the government.

Insurance Companies

Insurance companies sell health coverage plans directly to patients or indirectly through the employer or governmental intermediaries.

Pharmaceutical Firms

develop and market medications that are prescribed by doctors to treat patients. They receive remuneration through insurance or governmental drug-benefit plans. The prices for drugs are rising, and there are no caps to prevent them from reaching extravagant prices.



Government

government subsidizes healthcare for the elderly, the disabled, and the poor. All stakeholders have duties and responsibilities.

Facts and figures

A survey of European health professionals found that they believed the biggest E-health trend in the coming years will be the use of patient owned health data.

India's healthcare sector was worth over 140 billion U.S. dollars as of 2016, with projections to reach up to 372 billion dollars by 2022. The country's healthcare market had become of the largest sectors in terms of revenue and employment

DOCTOR:PATIENT ratio remains poor (1:1000) though MT booms.

Stakeholder Health partners share a commitment to the optimal fulfillment of their CHARITABLE MISSION, focusing on efforts in communities where health disparities are concentrated.

MT sector is experiencing a growth of 22-25% and has reached approximately USD 6 billion in 2018.

mosquitoes kill at least 725,000 persons every year

In 2019, 42 % of Americans reported using digital health tracking.

The UV region covers the wavelength range 100-400 nm

The government spending on healthcare has INCREASED to 1.4 % of GDP in 2018. It is planning to further enhance this to 2.5% of GDP by 2025.

In 2020, over 21 billion U.S. dollars was invested in the industry, compared to around one billion U.S. dollars in 2010.

Although deaths from HIV/AIDS have decreased over the last few decades, there were still around one million AIDS-related deaths in 2017.

By 2050, there will be nearly 1.5 billion people over the age of 65, compared to 524 million in 2010.

Tuberculosis is one of the deadliest communicable diseases worldwide, causing around 1.3 million deaths per year.

Some of the top healthcare companies in India include Dr.Reddy's Laboratories, Cipla, Wockhardt, Religare, Apollo, Fortis and Piramal.

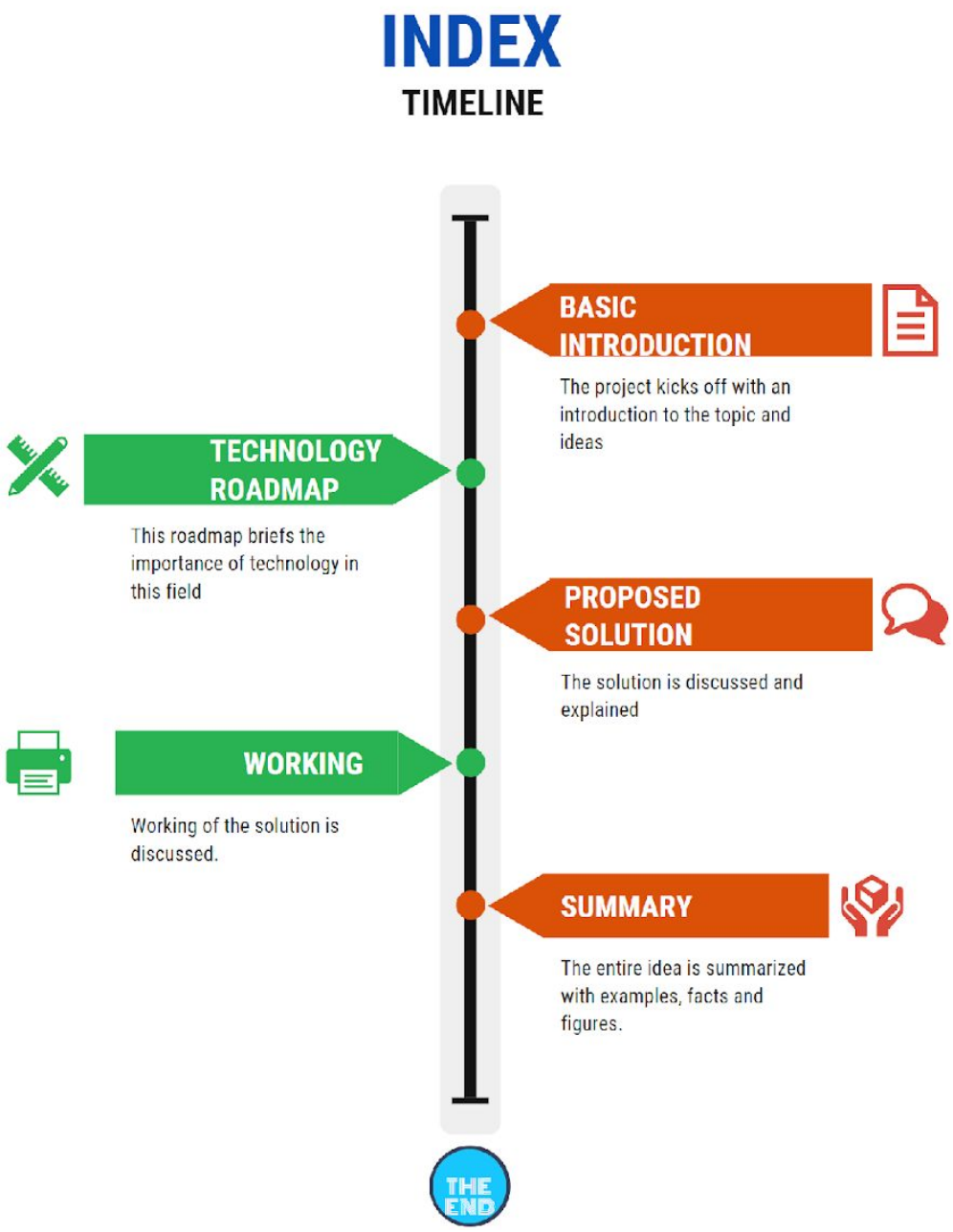
Low-pressure mercury lamp, excimer lamp or far-UVC lamp, Pulsed xenon lamps, Light-emitting diodes(LEDs) are the different types of lamps that can produce UVC radiation

1. https://www.statista.com/statistics/1092869/global-digital-health-market-size-forecast/
2. https://www.carepredict.com/news/this-digital-health-company-is-using-ai-to-improve-senior-care/
3. https://www.statista.com/statistics/701556/healthcare-sector-size-india/

Innovation Think Tank
Proactively drive innovation to improve human life

All In One Medical Interface

Digitalization



Proposal 1:

Workstream:COUNTERING INFECTIOUS DISEASES

Subtopic:

SIEMENS Healthineers

Key specifications

- Cumulative Data Access
- Collective Health Information in a Single e-card

Customer pains / challenges /motivation

Challenges:

1. There are no real-time updates on how an illness is spreading in a specific location.
2. Patients and hospital staff are both confused due to inconsistency and misplacement of health records.
3. Overcrowding in hospital outpatient departments might be a breeding ground for a variety of infectious diseases.
4. Restricting Passengers with infectious diseases who are travelling abroad.
5. Lack of mass electronic health records (EHR) to determine the beginning of epidemics and pandemics
6. Keeping the public from going out regularly, particularly during a pandemic or when the government is on lockdown.

Motivation:

- xxxx

Current state of art

- With Regards to ongoing COVID-19 pandemic:

- European Commission proposed a vaccine passport mechanism in March,2021 . The proposal if approved could allow free movement of EU citizens within 27 EU member states by this summer.
- **As the pandemic is regaining momentum – immunization being a prerogative makes vaccine passports essential to ensure incoming people are safe and aren't carriers of the virus.**
- China, Philippine**s and UAE launched similar certifications to ensure safe and transmission free travel.**
- **WHO Emergency Program Director Michael Ryan believes Immunity Passport could help lead us out of the pandemic.**

Customer value

- Provides information about high--risk patients
- Citizens can be made of high-risk zone
- People can use health passport for smoother travel in pandemic

Business impact

- Curb Infections
- Ensure a safer population
- Easier monitoring

Description of the proposal/solution

A web and mobile application run by an organization along with the governments of respective countries.
Every hospital must mandatorily register under this organization
The app will be connected to a person's unique identification details, such as an adhar card in India, which the government can make mandatory for all residents in order to keep a large database of health records.After linking each person gets a unique user id in the app in which the persons records and other details are stored.
Features of this app:

1. **Demographic Surveillance System**: Real-time updates and alerts if there is an abnormal rise or spread of disease in a locality.
2. **Electronic Health Record management system** to manage health records of patients in organized manner.
3. **Automatic scheduling system** for patients in out-patient department along with OTP operated doors for waiting rooms to prevent crowding.
4. In patients records and **vitals management** and scheduling system for doctors.
5. Issuing **Health Passport** to international passengers for travel based on their past health records.
6. Artificial intelligence or machine learning algorithms to determine the start and spread of new epidemics or pandemics.
7. **Crowd control** Only during lockdowns, tracking systems are used to monitor people's movements. If people go out in excess of the government's prescribed limit, it will be observed and fined accordingly.

Recommendations and measures

- Health passport can be extended to beyond the pandemic measures in a regular basis to keep track of incoming patients into new countries.
- Further track record of people's health status can be kept.

Efforts

- Application to monitor the overall surveillance
- Cloud storage for information storage

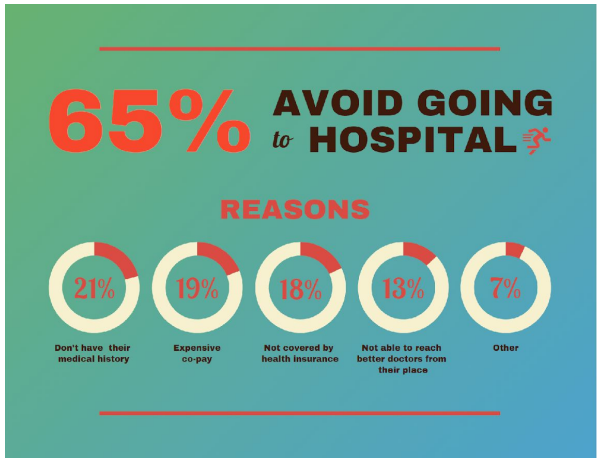
Content

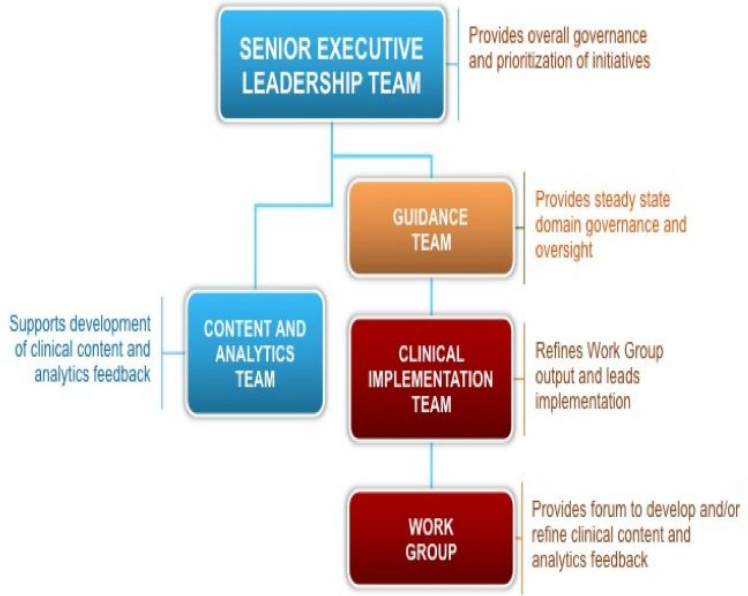
Why is data warehousing required?

The data warehouse is a centralized repository for data that allows organizations to store, integrate, recall, and analyze information. Healthcare organizations may wish to use their warehouses perform clinical analytics using patient data stored in the EHR, or they may try to improve their financial forecasting by diving into business intelligence and revenue cycle analytics using claims and billing codes.

By analyzing patient data and making it accessible through a data warehouse, providers can use the information to make better clinical and operational decisions. Data analytics can help to reduce the number of repeat visits from patients by identifying trends and recurring issues. Opening hours and staffing levels can be determined and improved based on data collected from patients.

In underdeveloped or over Populus countries the main issue in health care system digitalization is data warehousing. It becomes nearly impossible to collect and segregate all the required data.





https://www.healthcatalyst.com/why-healthcare-data-warehouses-fail/

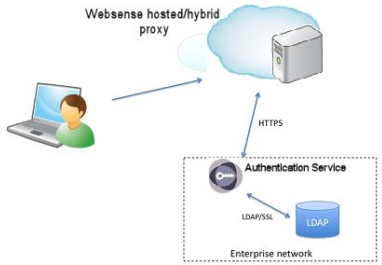
Prototypes

SIEMENS Healthineers

Artificial Intelligence

Demographic surveillance

Authentication services

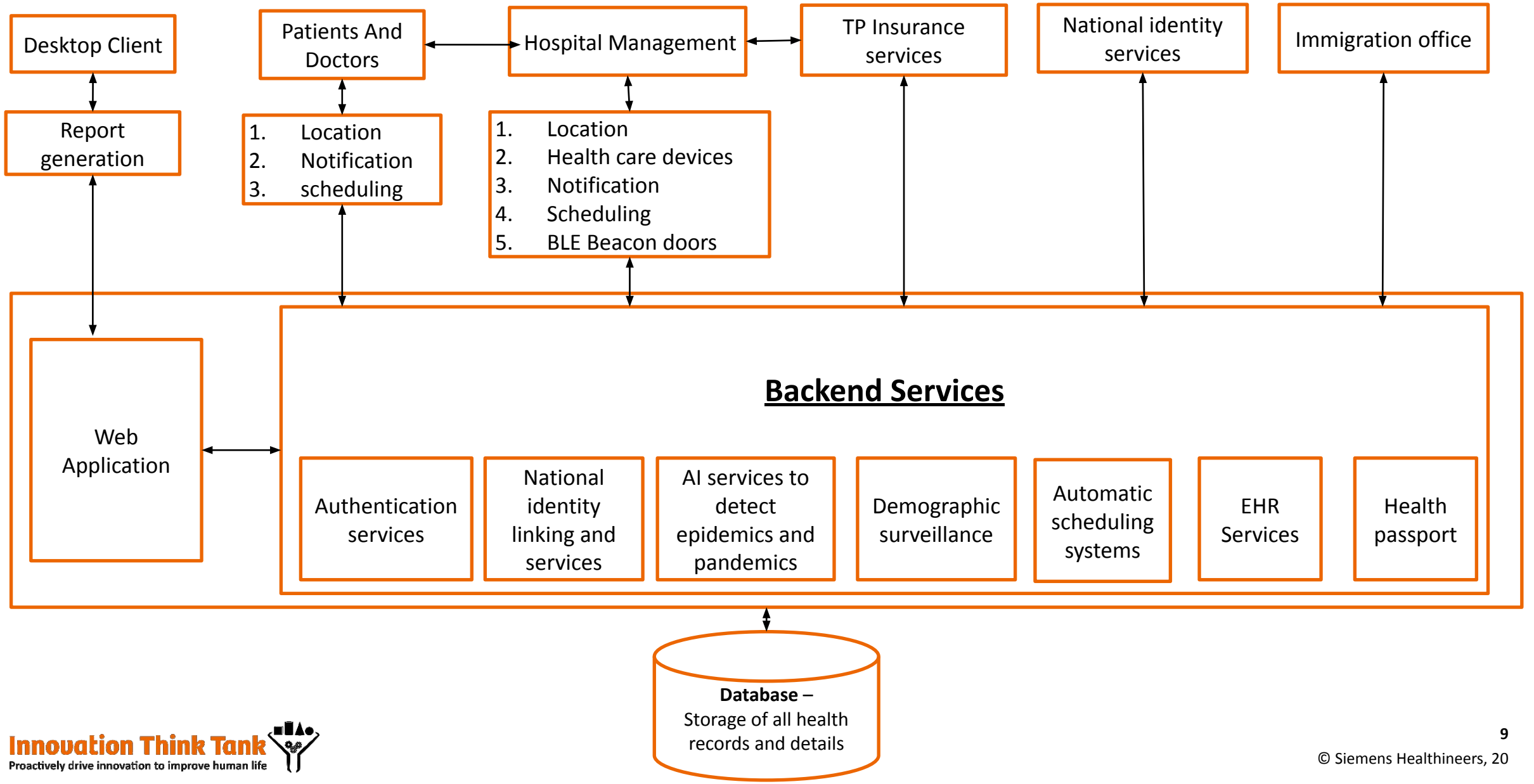


Automatic Scheduling

EHR Services

Health passport

High Level Architecture Of the All In One Medical Interface



Innovation Think Tank
Proactively drive innovation to improve human life

- Inadequacy in Safety and Sterilisation
- Pandemic Preparedness Plan

INFRASTRUCTURE

SIEMENS Healthineers

INDEX

Proposal 2:

Workstream:COUNTERING INFECTIOUS DISEASES

Subtopic:Infrastructure

ELECTROMYOGRAPHY and UV

Key specifications

- Neuromuscular Simulator
- Human Machine Interaction
- Wearable Biomedical Instrument
- Automated Disinfectant

Customer pains / challenges /motivation

Challenges:

- A sparking rebellion arises among the frontline medical soldiers who are now being a victim of the communicable pathogens due to the inadequate safety gear and shortage of PPE kits making them abscond from their work. Many physicians have been considering themselves as the 'sitting ducks'.
- Physicians and nurses play a key role in ensuring that their patients receive adequate healthcare, but the vice versa doesn't exist. The lack of sterilization of the medical instruments becomes a source of transmission when used by a patient in an improper manner.

Motivation:

- The fragility of the public health infrastructure made us realise how these challenges might make them more susceptible in the unknown future. We came by a solution after giving a right track to our train of thoughts, which might make a difference in their lives.

Current state of art

Denmark based UVD Robots, a subsidiary of Blue Ocean Robotics

Example implementation or other industry implementations (if applicable):
The company's robots are able to disinfect patient rooms and operating theaters in hospitals. The robots consist of a mobile base equipped with multiple lidar sensors and an array of powerful short wavelength ultraviolet-C (UVC) lights.

Customer value

- Close interaction with the board of executives
- Inclusion of themes with a more practical and patient-oriented naturea.
- Collaboration of decisions on lower echelons of the organization

Business impact

- Objectives
- Quality of Goods
- Increased Grants
- Reliability of Deliveries

Description of the proposal/solution

COVID-19 made us move forward to a contactless world. A world wherein humans are afraid of touching each other in order to avoid any transmission of viruses. To bring this scenario a transition, we bring you "MyoUV", a revolutionary solution to mankind comprising of the hands EMG and the influencer UV.

- Bringing the concept of wearable sensors for the frontline soldiers to avoid contact with the patients
- Also proposing a change in the infrastructure of the isolation wards where the patient and the physician should maintain a distance by separating each other with a window such that the physician can monitor and control by staying at the other side of the window
- An autonomous robot comprising the prosthetic hands with a rotatable UV beams which can be controlled with the user or automated as well.

Recommendations and measures

- Clean your hands i.e the upper arm and the forearm gently and thoroughly remove any oils from the skin. **Don't** apply any lotions or creams after washing.
- Remove any jewellery or watches before the procedure
- Presence of human beings in the room are strictly prohibited when the UV disinfection takes place such that no harm can be caused from the UV rays.

Efforts

- Transforming large systems
- Improvements to clinical outcomes
- Patient safety , quality of care , and financial performance Commitment and effort.

PORTABLE FOLDING WARDS and DRONES

Key specifications

- Spatial folded structure
- Speedy to build
- Desired shape design
- Pre programmed flight paths
- Real-time interactions with humans
- Self-organized motion

Customer pains / challenges /motivation

Challenges:

- Pandemics a level after epidemics require a multisectoral response over a several months or even years. For this there is huge meagreness in the infrastructural operational plans at national and subnational levels.
- History speaks and now the present too, how exercising of the planning hasn't been done beforehand but the implementation done during the pandemic situation when most of the people are already affected.
- Urbanisation has made the population density increase more than ever leading to unavailability of access to health care in remote locations of the country

Motivation:

- Being part of an urbanised area, we look out through the windows and watch these people who spend day and night on the streets in front of the hospitals for their diagnosis who also serve as a source for transmission of diseases, it made us wonder how can infrastructure be the best method to tackle this problem.

Current state of art

Zipline is an American medical product delivery company headquartered in South San Francisco, California

Example implementation or other industry implementations (if applicable):
Zipline designs its own UAVs, launch and landing systems and logistics software for distribution of critical medical supplies.

Temporary quarantine camps have been introduced in several parts of the world with the aim of sanitization, temporary waiting for hospitals, screening and testing.

Customer value

- Functional
- Emotional
- Change of Life
- Social Impact

Business impact

- Services and Deliveries more accessible
- Location sitting
- Imagery analysis and data science across industries

Description of the proposal/solution

To be prepared beforehand in an infectious outbreak, we propose the beautiful concept of making Portable Camps/Isolation wards/Screening wards with a blend of Origami folding. These wards or camps can be easily setup in the remote locations wherein a solid infrastructure is difficult to build. Here, the delivery agents of the testing or diagnostic kit will be done via drones which will be carrying the supplies from the nearby hospital to the desired location.

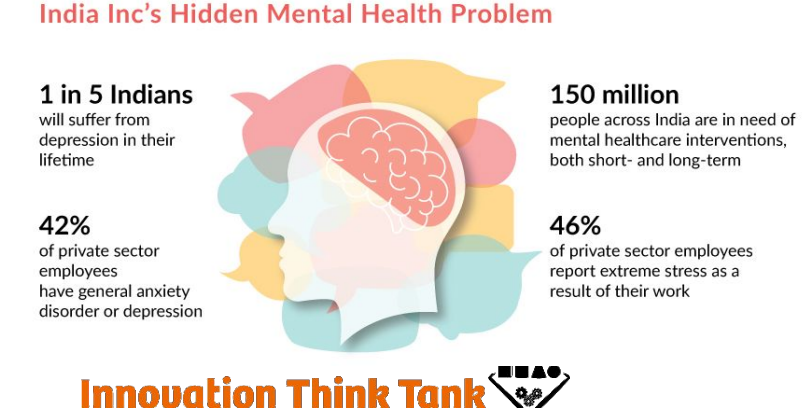
- Inspired from the Origami folding, and applying it to make infrastructure for short duration of time
- Drone Delivery Services is the need of hour
- Reaching long distances in shorter period of time
- Using computer vision and AI to further provide a transition into automated drone.

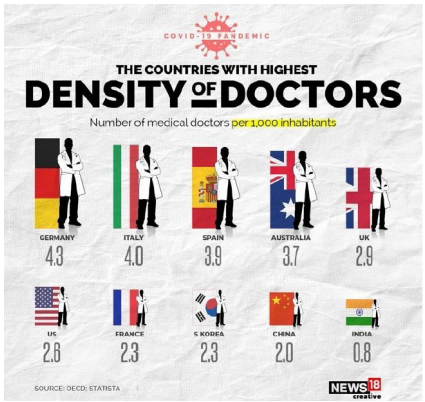
Recommendations and measures

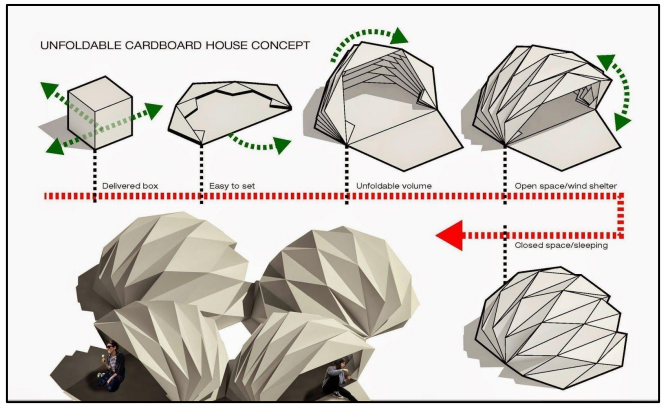
- Folding and Unfolding of camps require a limited amount of people
- THese structures should be kept at safe place to avoid any damage to it
- Further inside the camps, usage of transparent curtains can be done to keep people in isolation from the rest of the surroundings.
- Drone be operated by the people at warehouses with utmost safety when operated manually
- Medical kits to be packed with proper covering to avoid any damage

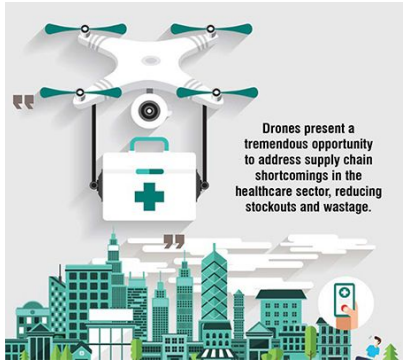
Efforts

- Caring people
- Developing a sense of belonging
- Experiencing reprieve and recreation
- Increasing knowledge, skills, and attitudes.
- Public Efforts









Content

WEARABLE SENSOR (EMG OR Electromyogram)

The human body is a wonder of nature. The EMG signal is a biomedical signal that measures electrical currents generated in muscles during its contraction representing neuromuscular activities. The nervous system always controls the muscle activity (contraction/relaxation). Moreover, the EMG detector, particularly if it is at the surface of the skin, collects signals from different motor units at a time which may generate interaction of different signals. Once appropriate algorithms and methods for EMG signal analysis are readily available, the nature and characteristics of the signal can be properly understood and hardware implementations can be made for various EMG signal related applications. Electromyography (EMG) signals can be used for clinical/biomedical applications, Evolvable Hardware Chip (EHW) development, and modern human computer interaction.

Useable energy of the signal is limited to the 0 to 500 Hz frequency range, with the dominant energy being in the 50 - 150 Hz range.

ULTRAVIOLET LIGHT

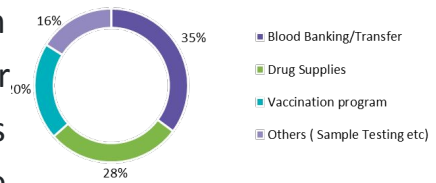
UV light is a reliable, well-studied antimicrobial technology. It works primarily by destroying the DNA inside bacteria, viruses and fungi. The high-energy portion of the UV spectrum called UV-C is most effective. UV-C light has been used for decades to disinfect industrial surfaces and sanitize drinking water.

UV light in the range of wavelengths between 200 and 300 nm is capable of inactivating microorganisms, such as bacteria and viruses, thus disinfecting both air and solid surfaces. Rapid decontamination of the used patient-care beds and hospital rooms before admission of subsequent occupants is a major requirement in hospitals in view of the limited availability of beds. Coronavirus is sensitive to UVC light, as in the case of other viruses and bacteria. The germicidal effects of UVC irradiation with a peak intensity at 254 nm results in cellular damage of the virus, thereby inhibiting cellular replication. Unlike chemical approaches to disinfection, UV light provides rapid, effective inactivation of microorganisms through a physical process.

DDS - DRONE DELIVERY SERVICES

Drone operators are providing delivery as a service to healthcare customers. They operate from distribution centers and warehouses stocked with medical commodities such as vaccines, blood units, test kits, and other medical supplies. On average, bigger operators have around 20 to 30 drones at each center, which allows them to simultaneously send more than one package when demand requires it. With drones having the potential to assist in emergency situations, continued technological advances in medical drones will drive the market demand.

Figure 1: Application Use of Medical Drones (in %)



Source: Beroe Analysis, marketwatch.com

CONCEPT of ORIGAMI

Nature has always given us the opportunity to learn and explore from them. One such concept whose origin dates back to 1603 and much before, is paper folding also known as Origami. While we think of origami as art, it increasingly is being used by companies and researchers in space, medicine, robotics, architecture, public safety and the military to solve vexing design problems, often to fit big things into small spaces. With the concept of paper folding being increasingly recognized as an area of engineering research it is being seen as a means to develop deployable and reconfigurable engineering systems that take advantage of their flexibility.

Orimimetrics is the application of folding to solve engineering problems. *Rigid origami* considers creases as hinges and models the material between creases as *rigid*, restricting it from bending or deforming during folding. *Kirigami* strays from traditional origami rules by allowing cutting in addition to creases, but provides a manufacturing advantage that is sometimes more suited to engineering applications. In many instances of so-called 'origami-based devices', 'kirigami' is the more appropriate label.

Prototypes

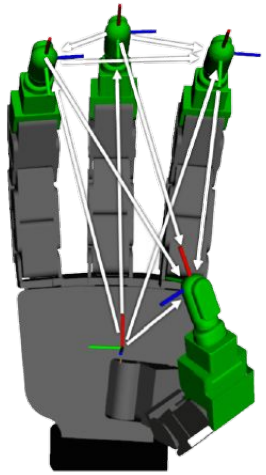
SIEMENS Healthineers

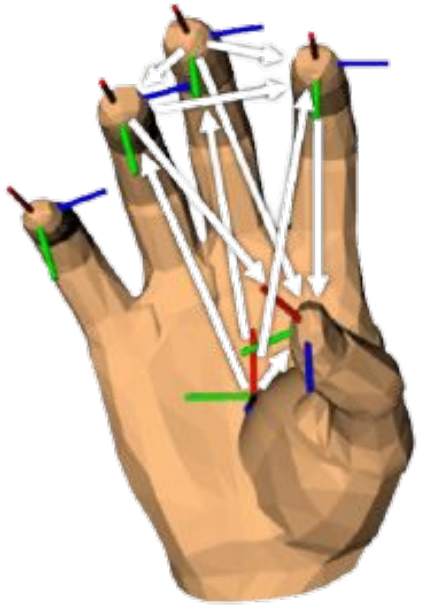
Your Safety has been our utmost Priority.

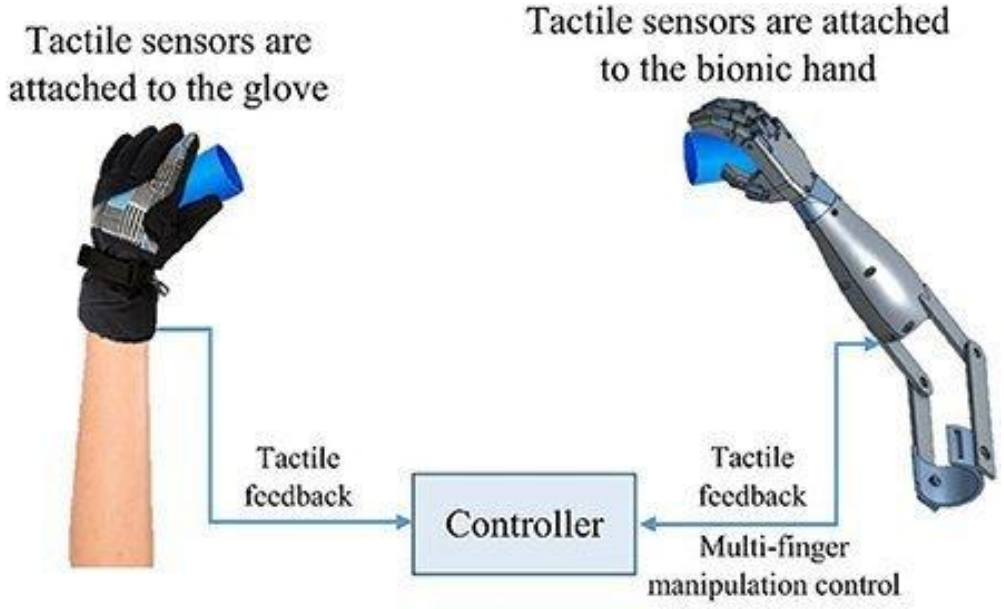
In order to provide a contactless solution where we want to safeguard the frontline medical soldiers from any sort of communicable infectious disease from the patient, we present you a solution in the form of biomed robot named “MyoUV”. According to our research this is the first robot comprising of ‘UV disinfection mechanism’ along with its prosthetic hands controlled and operated by the ‘Electromyography sensor’.

Who is the User?

The user is the concerned Physician who will be wearing an Electric Myo Armband on his/her Upper arm. Our proposal also comprises to keep the patient along with the robot in the isolation ward wherein we’ll have a separate section for the physician who is at a distance from the patient separated by a glass or a window to avoid any kind of transmission of diseases.

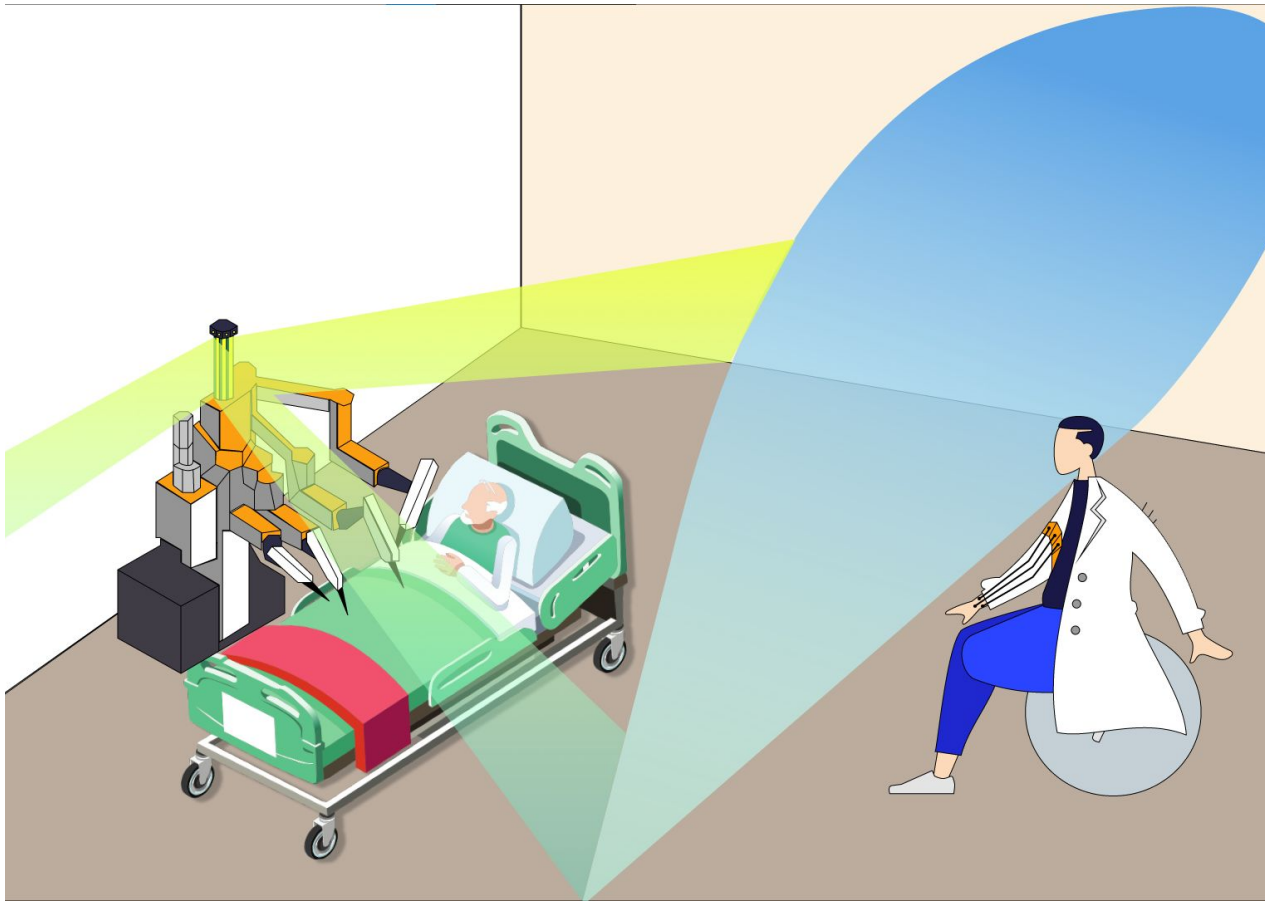


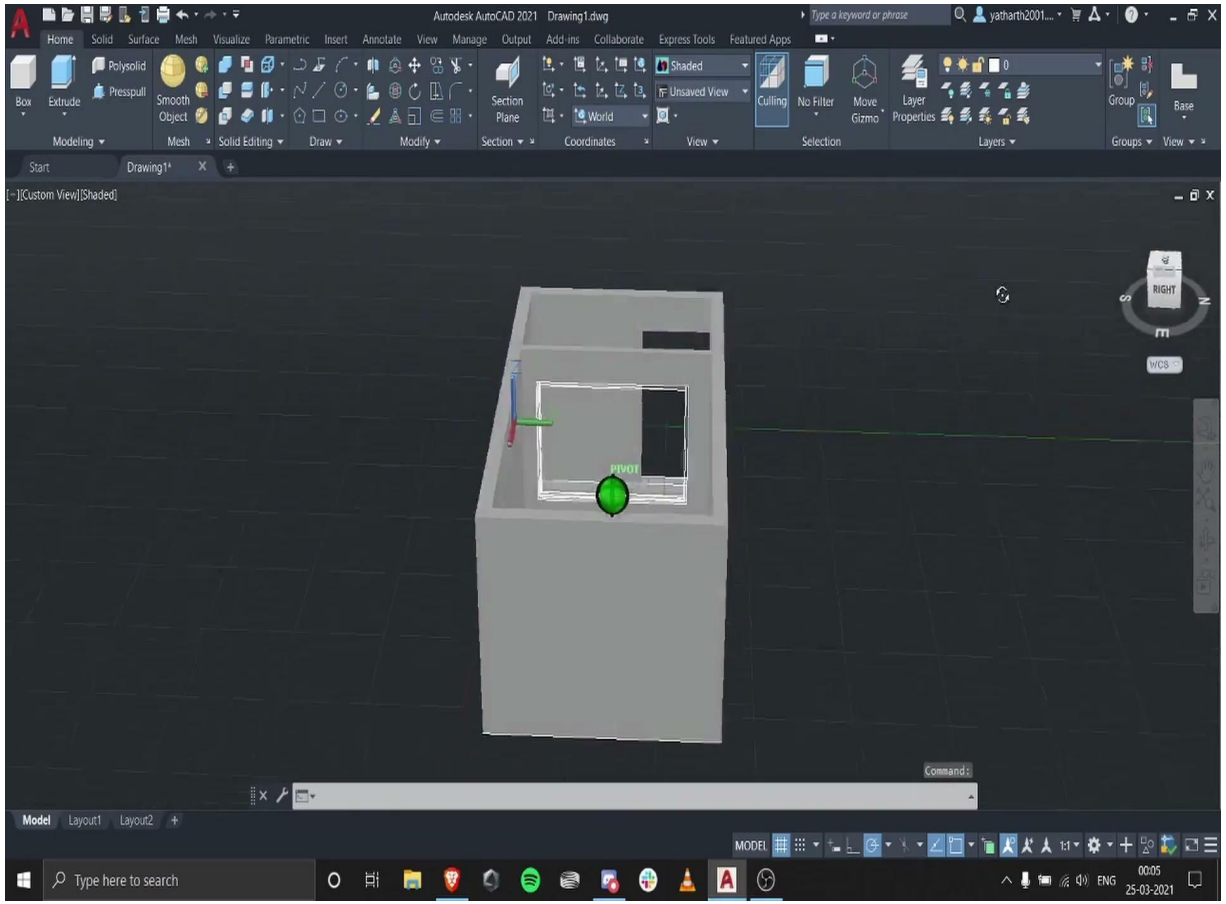




Innovation Think Tank
Proactively drive innovation to improve human life

A visual demonstration of “MyoUV”



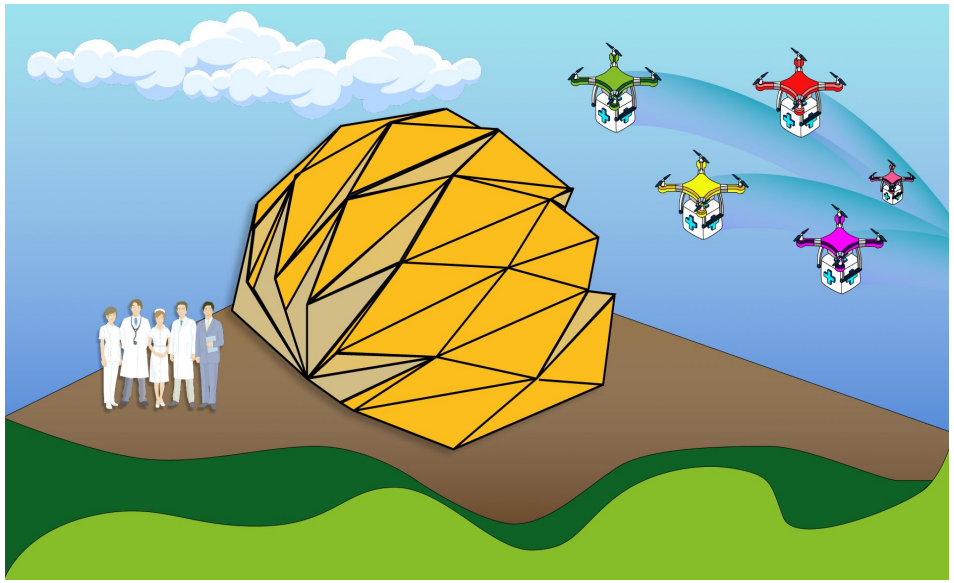


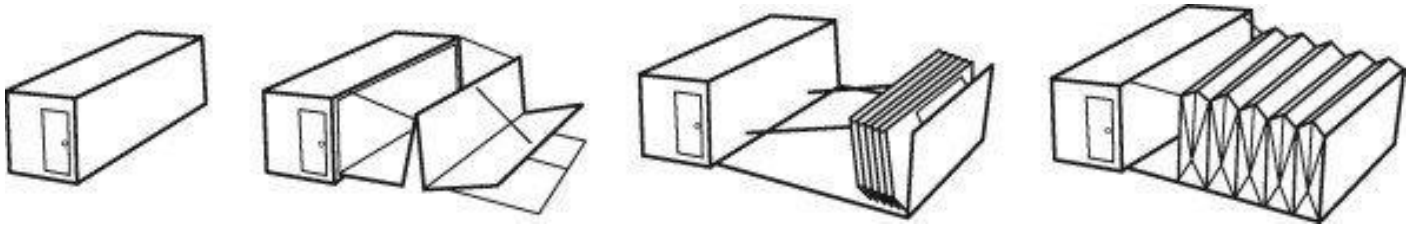
Prototypes

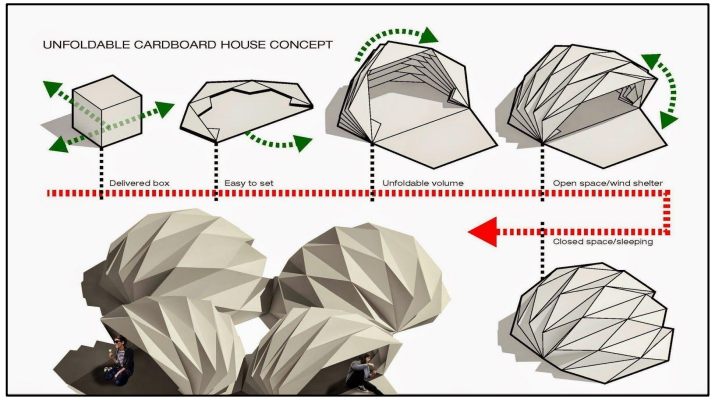
We propose you a new concept of delivery and setting up of health infrastructure named “Origone”.

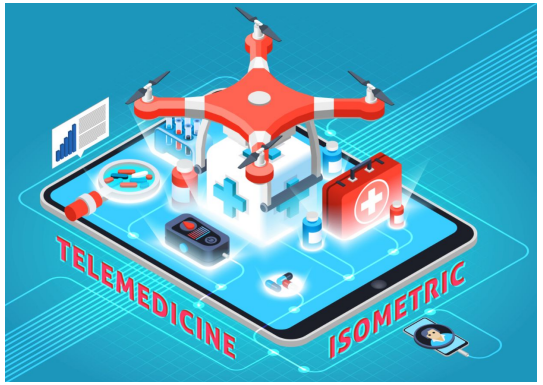
Setting up of solid structures are now a talk of the past, the future upholds the concept of “Origone”, the world’s first portable and foldable origami based Health Care infrastructure for the purpose of testing and diagnosis of patients where the delivery agents are the flying electronic machines called “Drones” who will be their to your rescue.
Accessibility has never been so easy until now where the drones come to your rescue for transporting and delivering purposes. These unmanned air vehicles may vary their luggage according to their size and shape.

These portable camps can be also setup with a view of isolation wards for short period of time. They can be considered as the key infrastructural change which the future looks upon.









Summary

SIEMENS Healthineers

Digitalisation

- There needs to be a proper technological system to counter any infectious diseases. To address this, we need to take in various technological investments and build a system that can ensure such harshened and unprepared response isn't in play during a possible infectious disease breakout.
- Thus, we have addressed this issue by proposing a proper countering mechanism both before a pandemic and during a pandemic.
- A data warehouse that is linked to a unique id generates the health profile of the patient and stores the medical history of that patient.
- With the demographic surveillance we aim to counter the infection by analyzing abrupt rise in sickness or spread of disease. The application shall alert and restrict movements along such zones
- An automatic scheduling system – to address the needs of patients in outpatient zone – it schedules an appointment which automatically is rescheduled if you don't make it on time and to avoid unnecessary crowding OTP operated doors felicitate the movement through the rooms.
- Health passport has been proposed to allow travel of people whose medical history is known and amidst a pandemic their history of infection/testing and immunization is revealed to the destination country.
- Thus, addressing the various demands we have proposed a solution to counter the spread of the infectious disease.

Infrastructure

- A developed health infrastructure also guarantees a country of strong and healthy manpower for the production of goods and services. Health infrastructure includes advanced machines, specialist doctors, nurses and other paramedical professionals, and developed pharmaceutical industry.
- Countering Infectious Diseases is certainly not an easy task where Health Infrastructure plays a vital role. In order to improve the structure we bring you our 2 most effective solutions to it i.e "MyoUV" and "Origone" whose focus is in countering the Lack of Safety and Sterilisation for Frontline Medical Soldiers and Pandemic Preparedness Plans.
- MyoUV is an autonomous as well as a manual controlled robot whose prosthetic hands are operated by EMG worn by the physician. As the name suggests it also comprises of a UV disinfection mechanism for sterilisation of the room and machines.
- Origone is a concept of building up of Foldable and Portable structures which can be turned into isolation camps or screening wards. Since we aim to make it up at the remote locations, we also provide the Drone Delivery Services to provide accessibility to essential therapeutic and diagnostic kits.

SIEMENS Healthineers

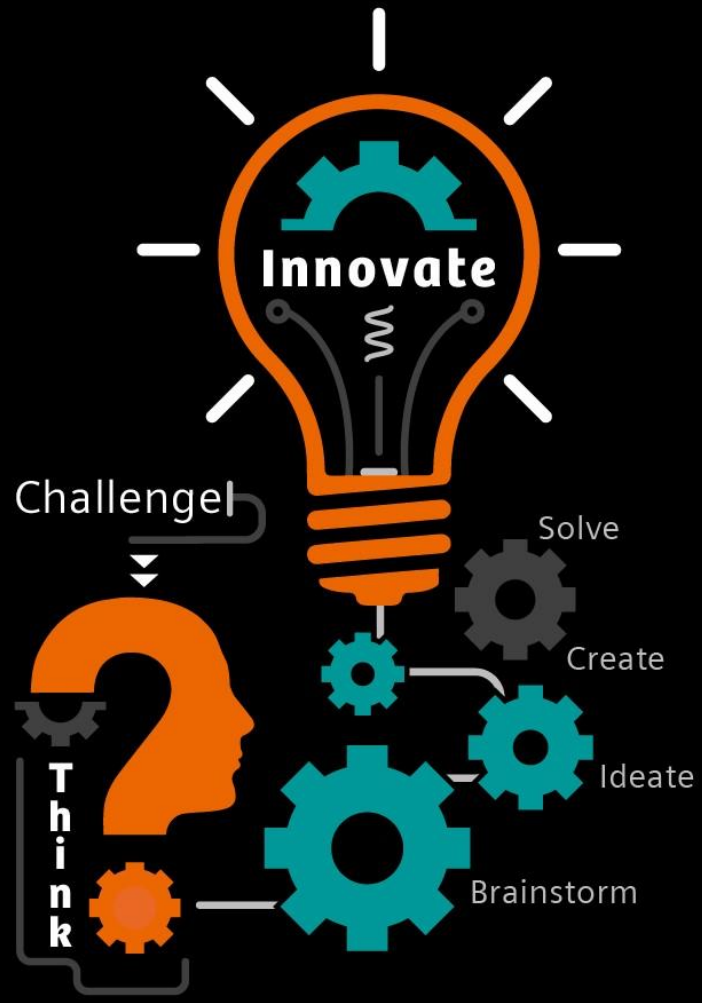
Innovation Think Tank Certification program, 2021

Organized by Innovation Think Tank, Siemens Healthineers, Bangalore and Siemens Shanghai Medical Equipment

(16th - 29th March , 2021)

Thank You!

Looking forward to meet you for the Q&A at the exhibition!



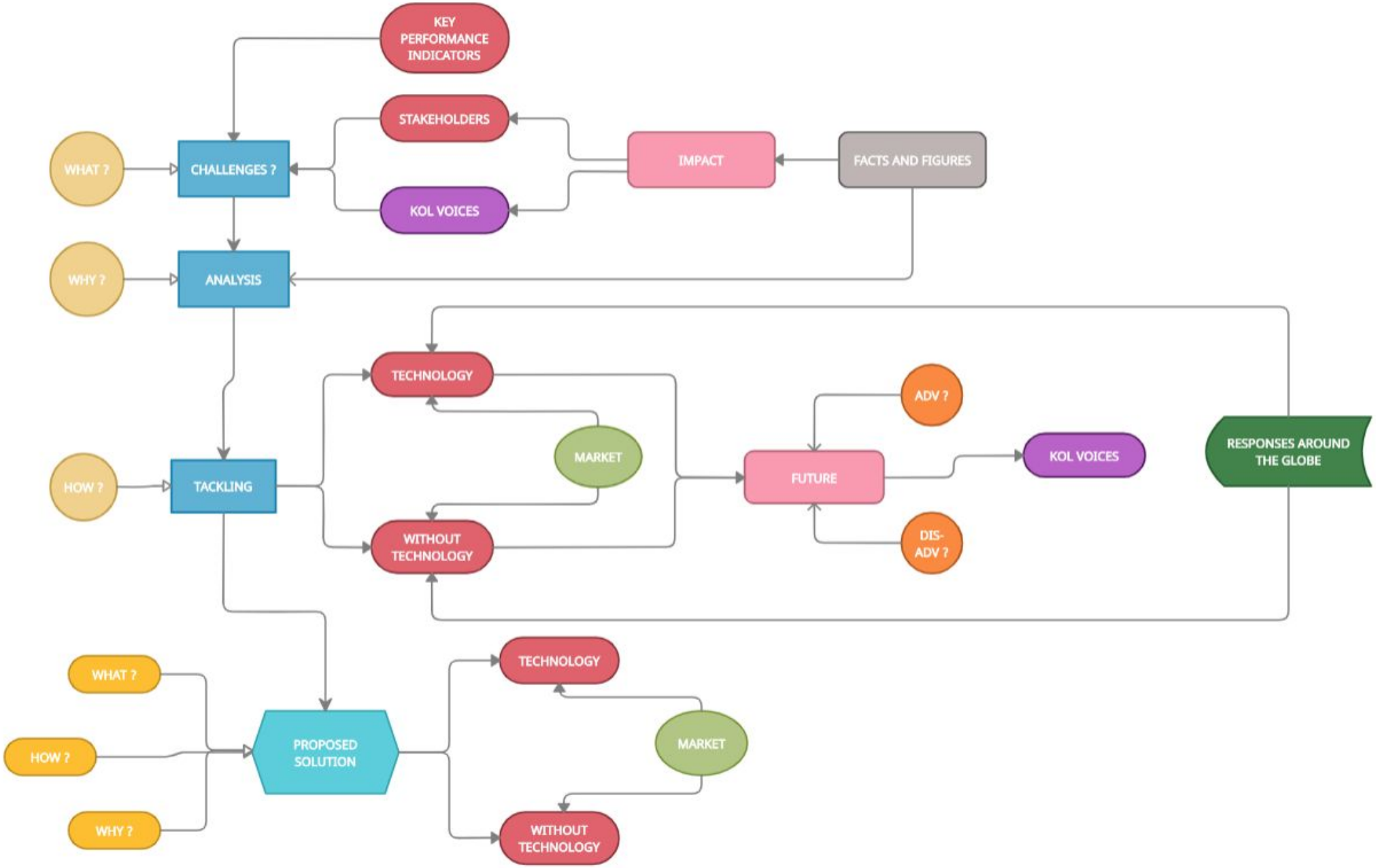
Innovation Think Tank
Proactively drive innovation to improve human life

SIEMENS Healthineers

Backup Slides For Reference

Digitalisation
Infrastructure

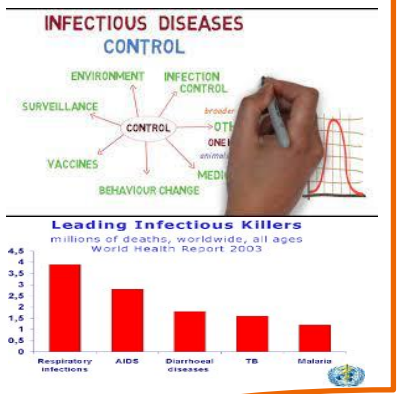
Innovation Think Tank
Proactively drive innovation to improve human life



Brainstorm on challenges, trends and technologies effecting

Infectious disease

Infectious diseases are disorders caused by organisms — such as bacteria, viruses, fungi or parasites. They are the leading cause of morbidity and mortality. **The "big 3" pathogens**—HIV, tuberculosis, and malaria—cause hundreds of millions of infections annually and collectively kill more than 5 million people each year.



lifestyle

In recent decades, life style as an important factor of health is more interested by researchers. According to WHO, 60% of related factors to individual health and quality of life are correlated to lifestyle. Millions of people follow an unhealthy lifestyle. Hence, they encounter illness, disability and even death.

3D Printing In Healthcare

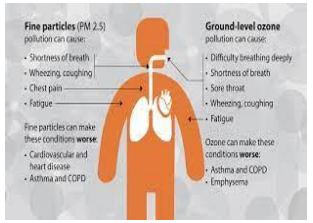
In **healthcare**, **3D** bioprinting is used to create living human cells or tissue for use in regenerative medicine and tissue engineering. Organovo and EnvisionTEC are the pioneers of this technology. **3D printing** is also used to manufacture precision and personalised pharmaceuticals.

Digitalization

Digitalization is one of the highest priorities in the **healthcare** sector these times. ... Growth of pharmaceutical costs, poorly integrated doctor-patient interaction, defects of medical devices delivery system, and patients data safety issues are among the problems that **healthcare** industry faces every day.

Smart Technologies

Smart healthcare is a health service system that uses technology such as wearable devices, IoT, and mobile internet to dynamically access information, connect people, materials and institutions related to **healthcare**, and then actively manages and responds to medical ecosystem needs in an intelligent manner.

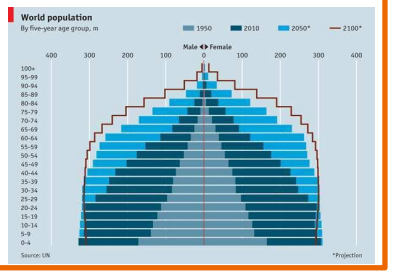


Air Pollution:

Exposure to high levels of air pollution can cause a variety of adverse health outcomes. It increases the risk of **respiratory infections**, heart disease and lung cancer. Both short and long term exposure to air pollutants have been associated with health impacts. More severe impacts affect people who are already ill.

Old population:

Older adults have different health care needs than younger age groups, and this will affect the demands placed on the health care system in the future. Older adults are more likely to suffer from chronic illnesses than younger people.



Brainstorm on challenges, trends and technologies effecting healthcare system

- Infrastructure of the hospitals
- Advancements in technology
- Irresponsible behaviour towards health
- Not everyone is able to afford treatment
- False information provided
- Economic recession
- Less hospitals beds available during pandemic
- High population density
- Some suffering from chronic diseases
- Mental health issues
- Management problems
- Globalization of food
- Halt on transit
- No international resource exchanging
- Price transparency
- Limited access to technology

KOL Voices

"There are a lot of peripheral computers out there that hospitals use to manage patients, to observe patients, and to keep track of how we're doing. From our standpoint, that's the issue we're facing right now. We need cost-effective, inexpensive products that can be easily integrated with our (EHR) Electronic Health Record systems."

-Dr.Seth Guterman
President of Healthcare Software Company Empower Systems

"We have binders and binders full of protocols that physicians have to find daily. There's no reason why all that can't be digitized and then through machine learning and then adding in voice, we can make accessing that information much more efficient."

-John Brownstein
Chief Innovation Officer & Digital Health Accelerator

"We are not going to be surrounded by lots and lots of big data, but the trick is to make that actionable information/personal information we can use, so we have to layer analytics to come into health care systems to understand you and give you your own early warning light when required."

-Daniel Kraft
Founding Executive Director and curator for Exponential Medicine

"We should use the tools of technology to do things we could never do before. For example, it used to be that if you wanted to see the doctor, you had to come see the doctor, but now a lot of that care can appropriately be pushed into the patient's home or another setting where it is easier for that patient to feel like they have access to care using technology tools."

-Dr. Bruce Darrow
Cardiologist at Mount Sinai & Chief medical information's office

"We also examined near-real-time emergency medical services and ambulance data, using ML to look for anomalies in the medical notes as patients were admitted to hospitals. In these instances, AI provided not only better detection of an abnormal disease event, but was able to do it faster -- weeks before traditional disease reporting would indicate a spike in disease"

-Steve Bennett
Director of public sector and financial services at SAS

https://cen.com/articles/2020/03/10/ai-coronavirus-tracking.aspx
https://www.varinsights.com/doc/are-you-targeting-healthcare-it-s-biggest-pain-points-0001
https://www.youtube.com/watch?v=zrW3-yzWt5Q&t=582s

KOL Voices

SIEMENS Healthineers

"Using the cloud, big data and AI applications creates room for industries to develop and build new business models that help citizens understand the severity of pandemic disease and ensure preventive measures"

-Sridhar Gadhi
Founder and Chief Executive Quantela

Quantela

"Looking to Meaningful Use Stage 3, we need to take all the disparate systems and get them to communicate with each other to get the full picture. We need to pull data into a single warehouse or repository where the organization can use the data and can-do analysis"

-John Daniels
VP of strategic relations, HIMSS (Health Information Management Systems Society)

HIMSS transforming health through IT

"We should be hopeful for technology for a couple of reasons, I think we have good evidence to say that these technologies can improve the quality and safety of the care health-related workers can deliver. No one is saying we should go back to paper. We know that there is going to be great value for these technologies in the field of healthcare."

-Tejal K Gandhi
MD, MPH, CPPS, Chief Clinical and Safety Officer, IHI

Institute for Healthcare Improvement

"algorithms to track social contact, inform people before they get sick, and let healthcare and governments know when infections are starting to spread. More generally, demand for automation through robotic, drone-based, and remote-control applications will also see growth. To add one more technology in the mix, consider AR/VR, which will also have a greater impact in remote work, entertainment, and services".

-Dr. Ikhlaq Sidhu,
Chief scientist, UC Berkeley Sutardja Center and Curriculum Chair at Plaksha University

Sutardja Center for Entrepreneurship & Technology

''I've had physicians come to me and say, I don't need you to make me better, I need you to make me faster. And if you don't make me faster, I won't use your technology. The goal should be finding places — throughout the entire system, not just the EHR — where they can be more efficient"

-Scott Farnsworth
Corporate director of clinical systems development, Kindred Healthcare

Innovation Think Tank
Proactively drive innovation to improve human life

Sources:
https://timesofindia.indiatimes.com/blogs/voices/covid-19-is-the-biggest-driver-of-digital-transformation-yet/
https://www.varinsights.com/doc/are-you-targeting-healthcare-it-s-biggest-pain-points-0001
https://www.weforum.org/agenda/2020/04/digital-infrastructure-public-health-crisis-covid-19/
https://www.youtube.com/watch?v=eBK3PNZj52k

KOL Voices

SIEMENS Healthineers

On Robots

"We worked hard for years to develop a robot and we have used that technology to create a product that responds to how the coronavirus has reshaped society"

Taisuke Ono
CEO, Donut Robotics

"Chemical disinfectants have also been recommended by the World Health Organization for disinfecting surfaces, particularly floors. However, these chemicals have residual effects and cannot be used to disinfect many articles like eatables, personal articles like laptop, mobile, watches and so on,"

Naresh Rakha
Senior Scientific Officer, IIT

On Drones

"You could really see how having drones deliver medicines to places we'd otherwise find difficult to reach would be useful"

Owen Wood, humanitarian pharmacy adviser
UK-based global charity Save the Children

On Data

"Our research shows that technology leaders understand that speed of innovation must also be matched with security, operational efficiency and reliability. As infrastructure and applications become more distributed and interconnected, the ability to connect and secure data as it travels across services and through clouds is vital."

Marco Palladino
CTO and CoFounder, Kong

"We are actively helping our clients to migrate their programs to include data intelligence monitoring tools. This ensures you have the most current actionable intelligence to proactively mitigate risk and optimize performance of your vendors".

Lori Frank
CEO, Argos Risk

On Drones

"The [drone] technology, which needs only power and cellular telephony, can be a leapfrog one in developing countries and can save the billions of dollars needed to build and maintain roads."

Andreas Raptopoulos
Founder and CEO, Matternet

On Engineering

TESLA

"Engineering is the closest thing to magic that exists in the world"

Elon Musk
CEO, Tesla Motors

"No country, hospital or clinic can keep its patients safe unless it keeps its health workers safe,"

Tedros Adhanom Ghebreyesus
WHO Director-General

"The striking conclusion from our survey is while covid is a public health crisis, it has also been a contagion across many other socio-economic challenges and government institutions"

John Gerzema CEO, Harris Poll

"It is crucial that we recognize the professionalism and dedication of health workers and invest greater resources to protect them from the occupational risks they face in the workplace. Months into this pandemic we still see countries facing challenges in procuring adequate personal protective equipment for health workers and increasing testing capacity, which is impeding early detection, isolation of cases and tracing of contacts. This is placing health workers at unnecessary risk of infection, especially as we know that a large number of people infected with COVID-19 are asymptomatic

Dr Ahmed Al-Mandhari,
WHO Regional Director for the Eastern Mediterranean.

"Fast prototyping stands out in terms of innovative thinking and proactivity. We translate Ideas into prototypes for the medical world. You can use our knowledge of this world and its specific requirements to make the right decisions early on and not be faced with any surprises at a later stage of your product design process".

Ronald Soupart Protoyping Specialist

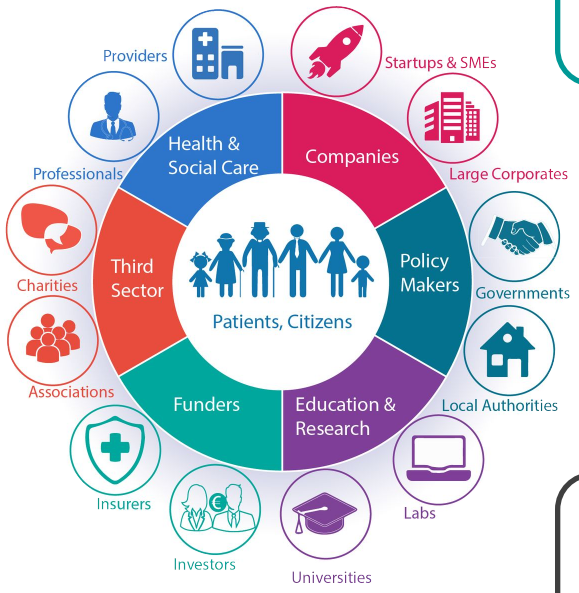
On Transformation

Microsoft

"What we were going to think about during 2030 is probably going to be true in 2025,"

Satya Nadella
CEO, Microsoft

Stakeholder Map For Healthcare System



- **External** -administrative stakeholders

- **Internal** – administrative stakeholders

Local government
Medical directors
sponsors

Board of directors
system adminstrative

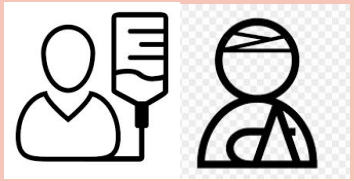
Doctors
technical staffs
patients
caseworkers

Medical board
nurses

- **Internal** – operations stakeholders

- **External**– operations stakeholders

Stakeholders



Stakeholders are those entities that are integrally involved in the healthcare system and would be substantially affected by reforms to the system. The major stakeholders in the **healthcare system** are patients, physicians, employers, insurance companies, pharmaceutical firms, and the government.

Patients

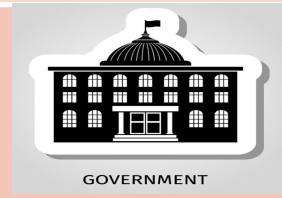
Patients are responsible for their own health and towards controlling costs. While it would be impossible to implement a program that forced people to live healthy lifestyles, it is reasonable to assume that healthier living would lead to lower healthcare costs.

Physicians

Ensures that their patients receive adequate healthcare, but also in controlling the rising costs of healthcare. They have to find a balance between having a gatekeeper role for the insurance companies and being an advocate for the patient.

Employers/Staff

Staff play a key role in day-to-dat management of the hospital. Also, many employers offer health insurance coverage with varying deductibles and co-pays for their employees.



Insurance Companies

Insurance companies sell health coverage plans directly to patients or indirectly through the employer or governmental intermediaries.

Pharmaceutical Firms

develop and market medications that are prescribed by doctors to treat patients. They receive remuneration through insurance or governmental drug-benefit plans. The prices for drugs are rising, and there are no caps to prevent them from reaching extravagant prices.

Government

government subsidizes healthcare for the elderly, the disabled, and the poor. All stakeholders have duties and responsibilities.

Challenges / pain points

S.No	Stakeholder	Pain point/challenge	solutions
1	Patients	A healthy population not knowing about the contaminated regions, thereby increasing the chances of getting infected	**Demographic surveillance system**– data collected from the infected person must be used to alert new people when they enter highly contaminated areas
2	Hospital management and patients	Conventional health records such as files and papers get lost or misplaced and hard to keep track my both patients and doctors.	**Mobile app health record management** – all the medical data and records are stored in an app that can be accessed by both the patient and the assigned doctor.
3	Government, public	Restricting infected passengers travelling between countries being virus carriers and transmitters especially during pandemics.	**health passport-** government issued no objection certificate for travelling abroad based on person's past health records
4	Physicians	transmission of infections amongst doctors-nurses and physicians due to contact with the patients.	**Automated hospital-** try to minimise the human contact by automating as many equipment's as possible
5	Patients and hospital	To know if this kind of disease has already occurred in the past	Proper warehousing of data of health records needs to be done and maintained

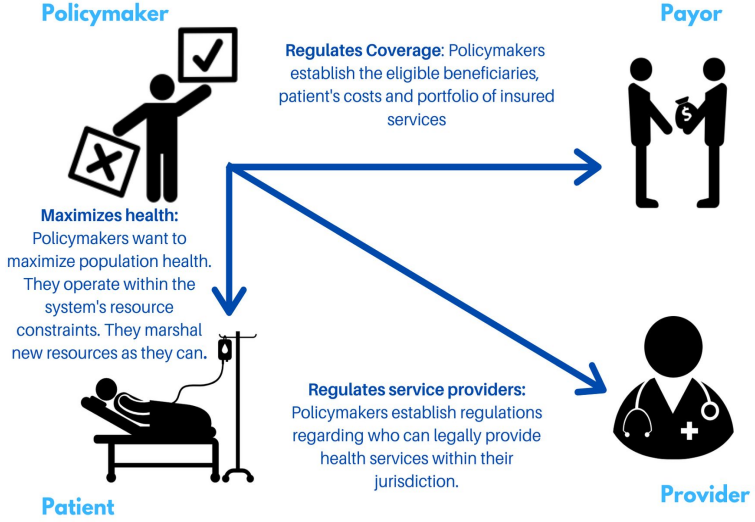
Challenges / pain points

S.No	Stakeholder	Pain point/challenge	solutions
6	Hospital management and physicians	Maintaining binders and binders full of protocols that physicians have to find on a daily basis.	All the records and information can be digitized and then through machine learning and adding in voice, we can make accessing that information much more efficient
7	Government and doctors	near-real-time emergency medical services and ambulance data, using ML to look for anomalies in the medical notes as patients were admitted to hospitals.	Pulling of scattered data into a single warehouse or repository where organization can use the data and can do analysis
8	Public and government	Managing crowds and avoiding too much accumulation of people when a lockdown is introduced in order to reduce infection. Alert the public regarding arising infection.	Demographic surveillance and Contact tracing
9	Hospital management and patients	Confusions and overcrowding of OPD due to poor management could be a contamination zone.	**Automatic scheduling systems:** app that schedules appointments of patients automatically based on their location. Only a limited amount of patient could enter the waiting room or clinic.
10	Physicians	I've had physicians come to me and say, I don't need you to make me better, I need you to make me faster. And if you don't make me faster, I won't use your technology.	Use of latest connective technologies and automation devices to make the work more faster.

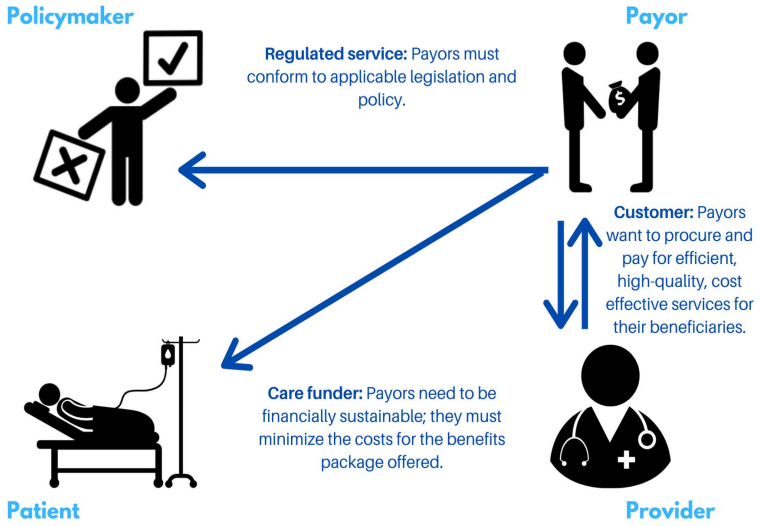
The Key Stakeholders: Patient, Policymaker, Payor, Provider

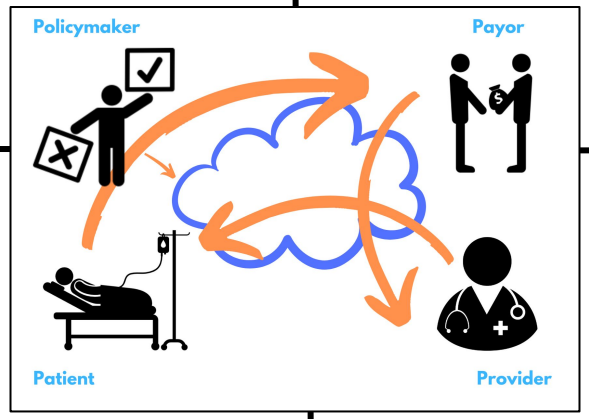
SIEMENS Healthineers

Policymaker's Viewpoint

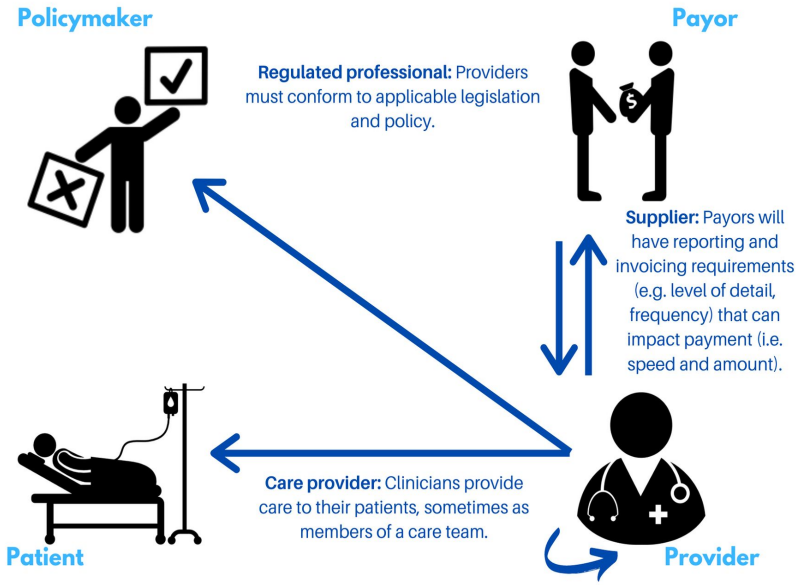


Payor's Viewpoint

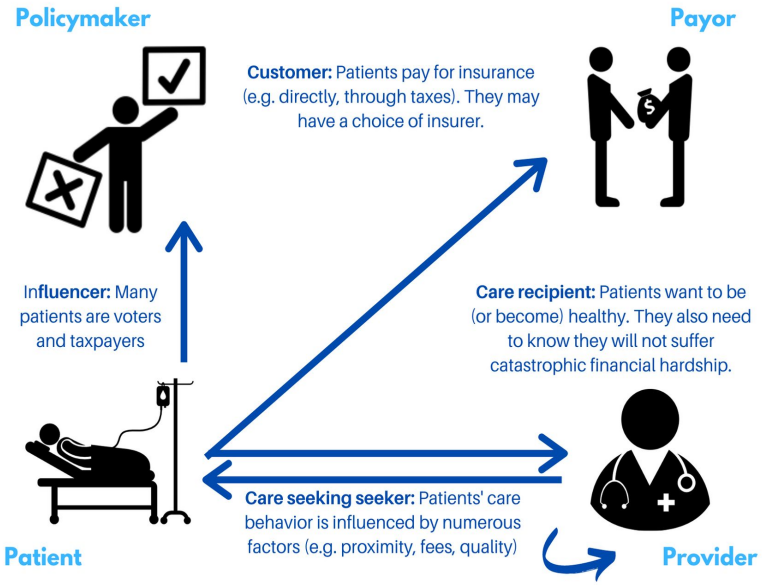




Provider's Viewpoint



Patient's Viewpoint



Innovation Think Tank
Proactively drive innovation to improve human life

Stakeholders Pain Points

SIEMENS Healthineers

Patients

- Patients blame the healthcare system for lack of access, convenience and personalization
- Patients are not treated equally by the system
- health data from security breaches
- Providing quality care to remote patients

Government

- Absence or the humanpower crisis in healthcare
- Affordability or the cost of healthcare
- Accountability or the lack of it
- Awareness or the lack of it
- Access or the lack of it

Civil Society

- Considers that disease prevention and health promotion are not priorities for health
- Considers that lifestyle topics such as diet and exercise are within the control of the individual and that individual choice is the determinant of behavior

Physicians

- Bureaucratic (and otherwise flawed) healthcare systems
- Lack of time for patients.
- Political, social, or economic barriers to serving those most in need.
- Incurable diseases, the re-emergence of older deadly diseases, and the emergence of "superbugs" for which medical science has little remedy.
- Stress, burnout, and lack of work-life balance.

Stakeholders PainPoints

NGOs

- Lack of Maintenance
- Absence of Networking
- Lack of Funding
- No advocacy
- No strategic Planning

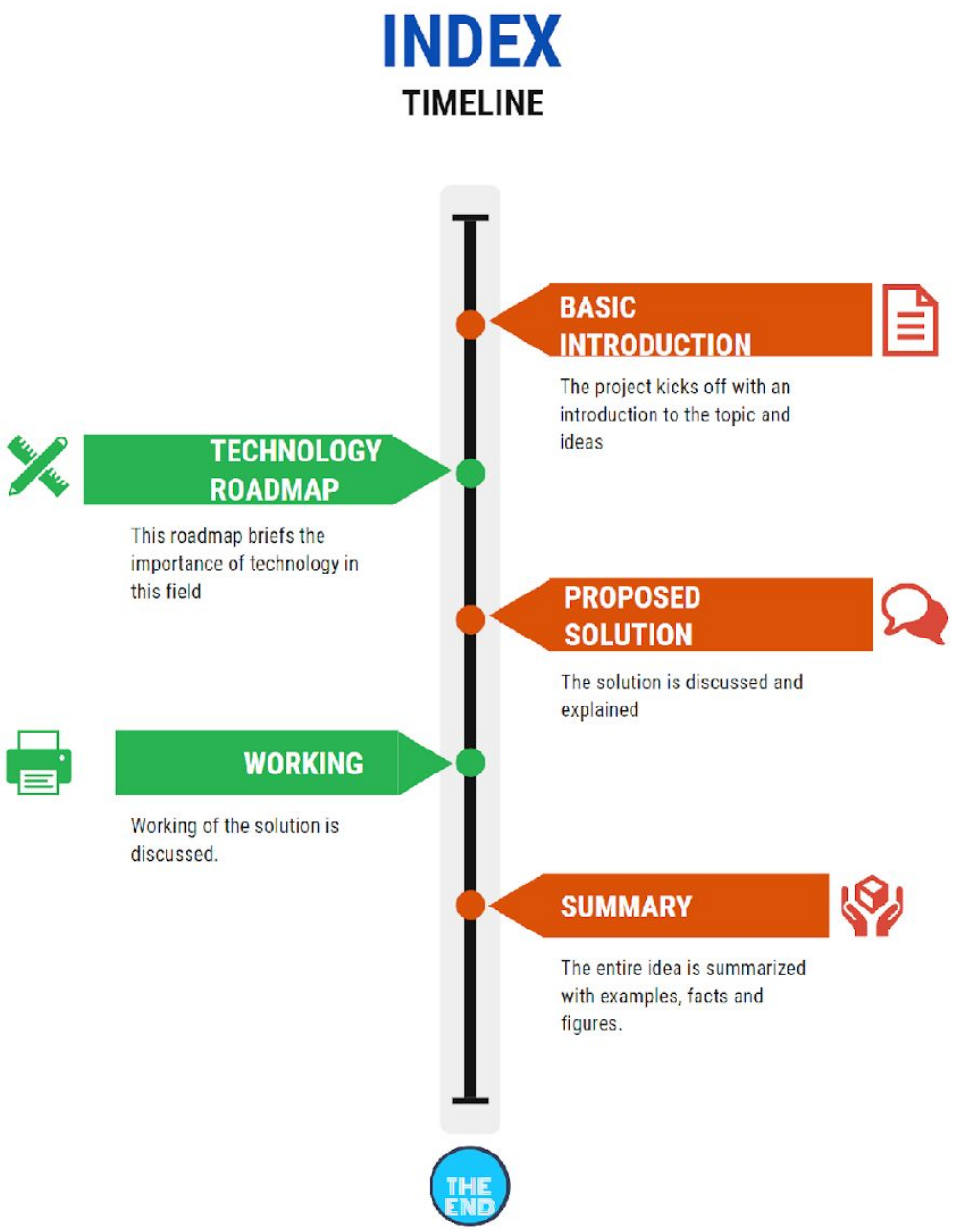
Employers

- Lack of being involved in national / local programmes
- Rising Health care costs
- Payment Processing and Invoicing
- Adopts the view that, 'the health of our employees is their affair, not ours

Innovation Think Tank
Proactively drive innovation to improve human life

All In One Medical Interface

Digitalization



INFECTIOUS DISEASES

SIEMENS Healthineers

INTRODUCTION

Infectious diseases are disorders caused by organisms — such as bacteria, viruses, fungi or parasites. Many organisms live in and on our bodies. They're normally harmless or even helpful. But under certain conditions, some organisms may cause disease. Some infectious diseases can be passed from person to person.

INFECTIOUS DISEASES
MAJOR - 4

MALARIA
Malaria is caused by Plasmodium parasites. The parasites are spread to people through the bites of infected female Anopheles mosquitoes.

COVID - 19
COVID-19 is caused by infection with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus strain.

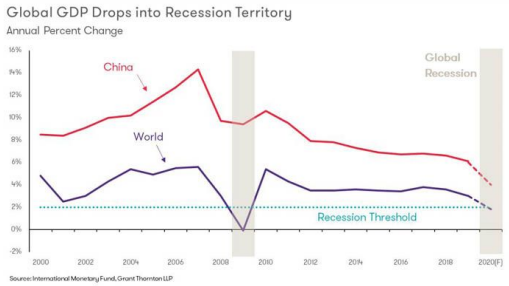
HIV/AIDS
HIV infection is caused by the human immunodeficiency virus. You can get HIV from contact with infected blood, semen, or vaginal fluids.

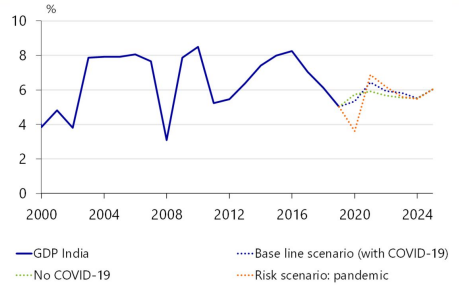
INFLUENZA
The flu is caused by influenza viruses that infect the nose, throat, and lungs. These viruses spread when people with flu cough, sneeze or talk, etc

SYMPTOMS

Fever → Diarrhea → Fatigue → Coughing

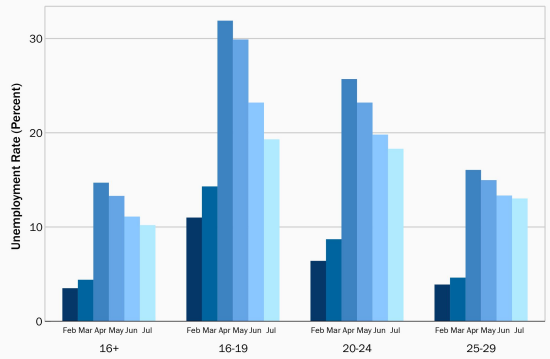
Innovation Think Tank
Proactively drive innovation to improve human life





Because of these infectious diseases, the economy of a country can get too low.

Figure 1. Unemployment Rate in 2020: by Age

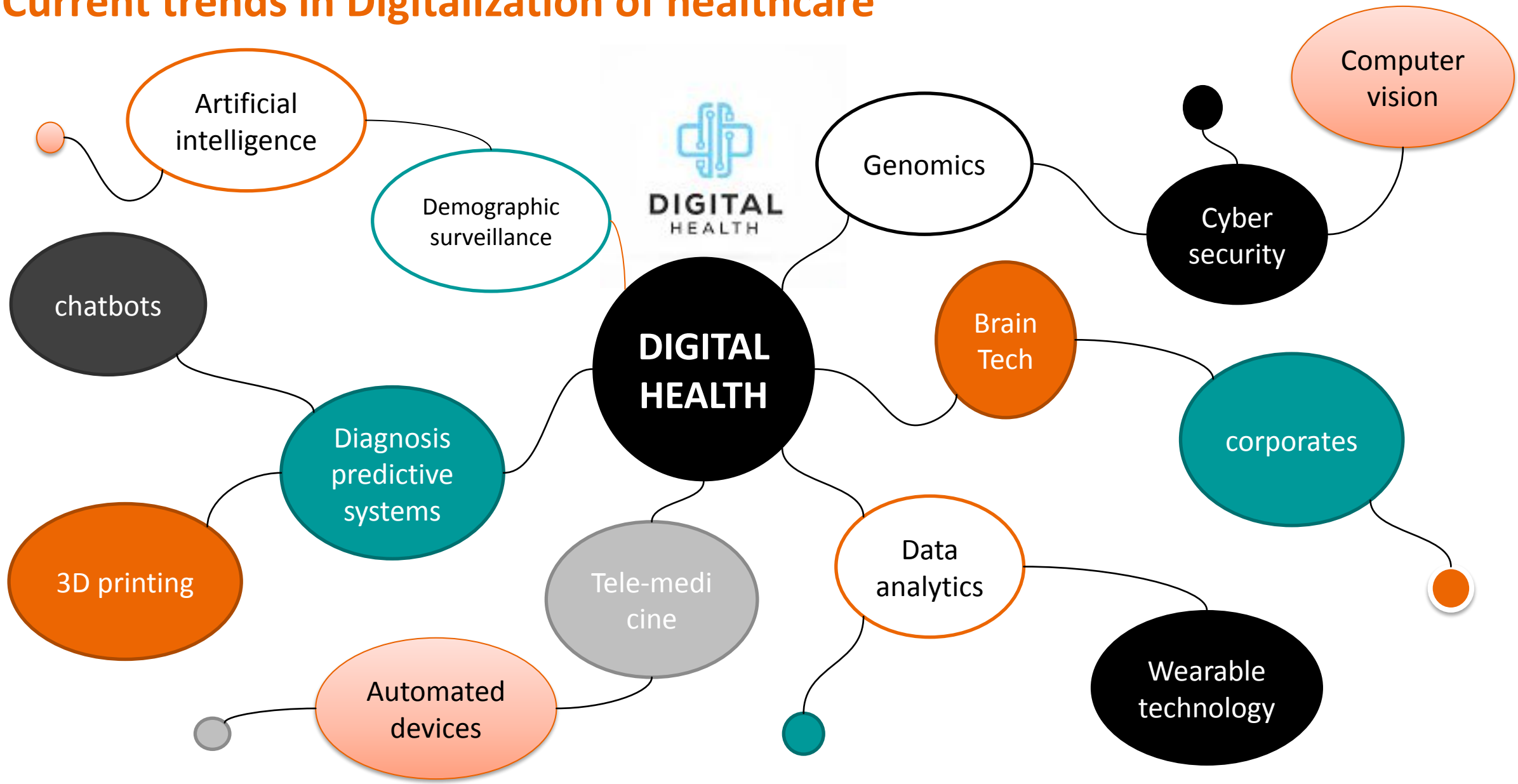


Source: Haver; Authors' calculations using the CPS.
Note: Seasonally adjusted.

Economic Studies at BROOKINGS

IMAGINATION VS. REALITY

Current trends in Digitalization of healthcare



Introduction

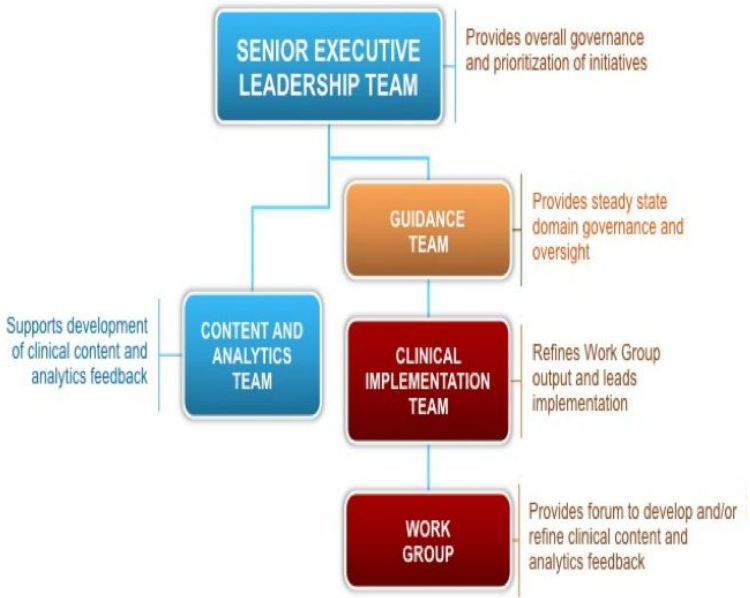
SIEMENS Healthineers

Why is data warehousing required?

The data warehouse is a centralized repository for data that allows organizations to store, integrate, recall, and analyze information. Healthcare organizations may wish to use their warehouses perform clinical analytics using patient data stored in the EHR, or they may try to improve their financial forecasting by diving into business intelligence and revenue cycle analytics using claims and billing codes.

By analyzing patient data and making it accessible through a data warehouse, providers can use the information to make better clinical and operational decisions. Data analytics can help to reduce the number of repeat visits from patients by identifying trends and recurring issues. Opening hours and staffing levels can be determined and improved based on data collected from patients.

In under developed or over Populus countries the main issue in health care system digitalization is data warehousing. It becomes nearly impossible to collect and segregate all the required data.



https://www.healthcatalyst.com/why-healthcare-data-warehouses-fail/

Challenges

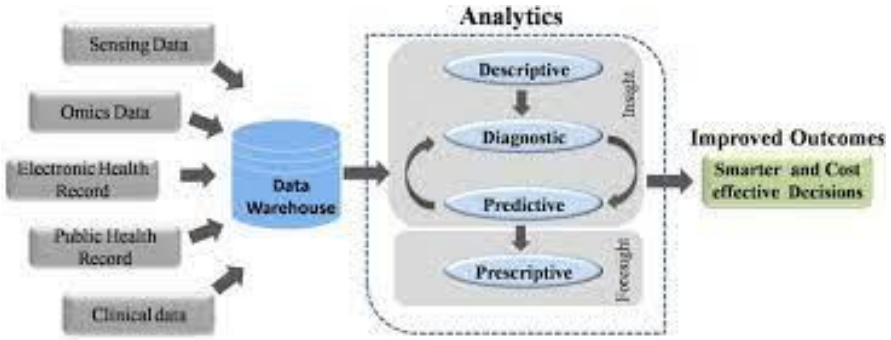
With our proposal idea a list of challenges currently being faced in the health care industry could be solved with the help of data warehousing and analytics.

S.No	Challenge
1	A healthy population not knowing about the contaminated regions, thereby increasing the chances of getting infected
2	Conventional health records such as files and papers get lost or misplaced and hard to keep track my both patients and doctors.
3	Restricting infected passengers travelling between countries being virus carriers and transmitters especially during pandemics.
4	Maintaining binders and binders full of protocols that physicians have to find on a daily basis.
5	near-real-time emergency medical services and ambulance data, using ML to look for anomalies in the medical notes as patients were admitted to hospitals.
6	Managing crowds and avoiding too much accumulation of people when a lockdown is introduced in order to reduce infection. Alert the public regarding arising infection.

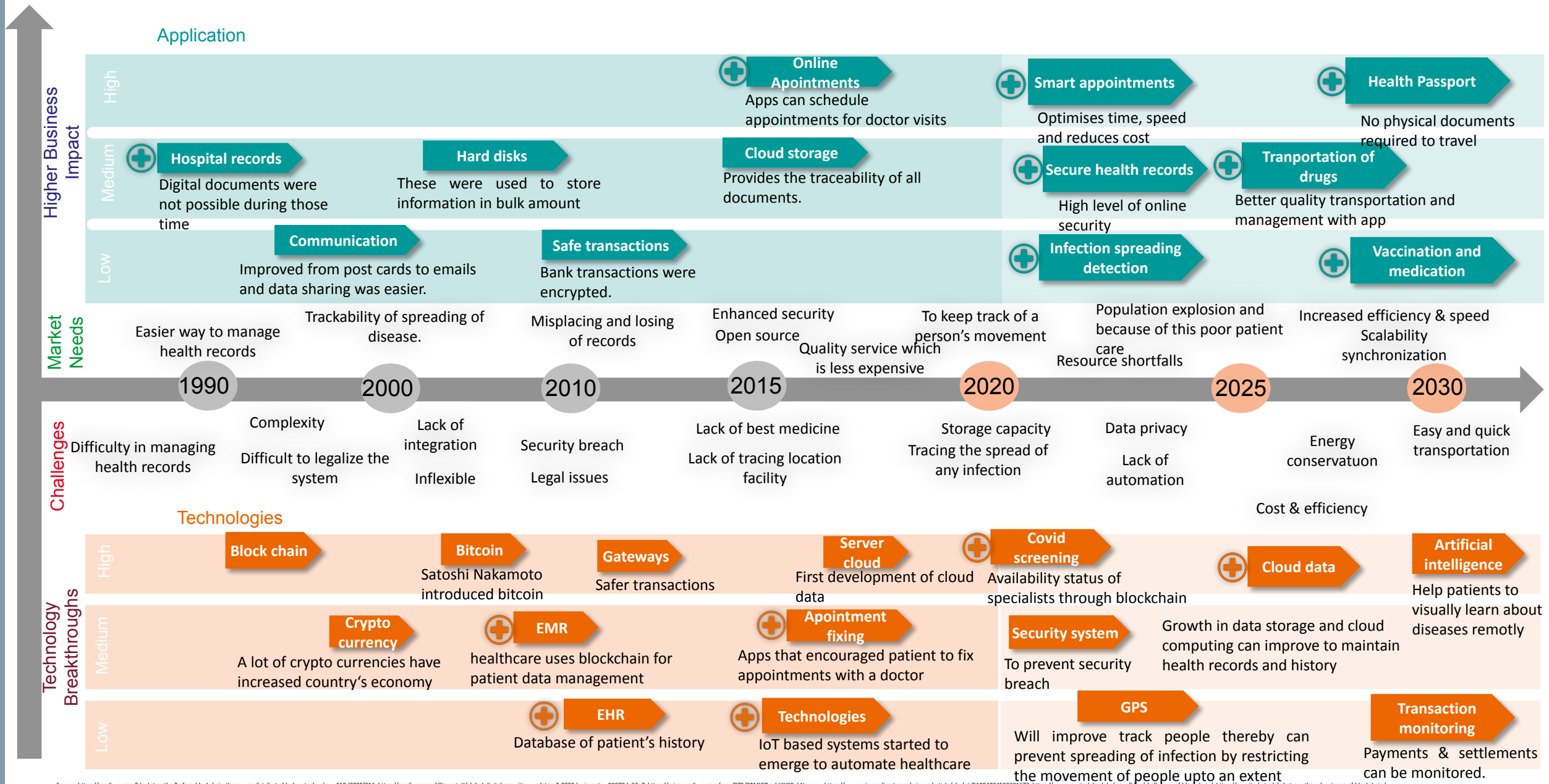
"Looking to Meaningful Use Stage 3, we need to take all the disparate systems and get them to communicate with each other to get the full picture. We need to pull data into a single warehouse or repository where the organization can use the data and can-do analysis"

-John Daniels
VP of strategic relations, HIMSS (Health Information Management Systems Society)

HIMSS transforming health through IT

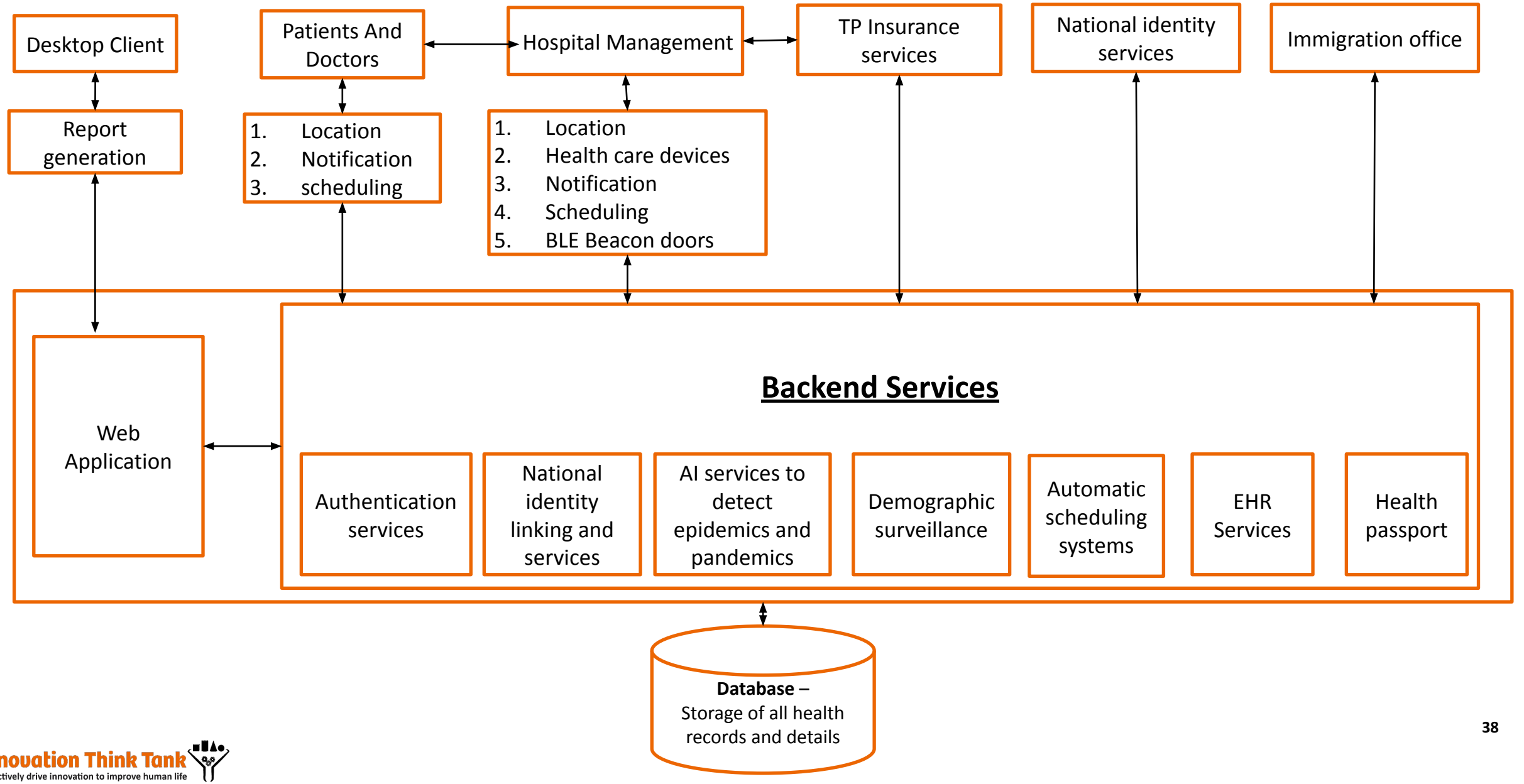


Technology roadmap



Source: https://medium.com/blockstreetho/before-blockchain-there-was-distributed-ledger-technology-319d0295f011, https://medium.com/@investaX/global-digital-securities-update-q2-2020-by-investax-89070da33e7, https://miro.medium.com/max/875/0*MICOnnhYJX0PokNu.png., https://www.sciencedirect.com/science/article/abs/pii/S1084804520301673, https://www.mantralabsglobal.com/blog/challenges-of-blockchain/, https://omnitude.tech/what-are-the-advantages-of-blockchain/, https://www.smartdatacollective.com/top-advantages-blockchain-for-businesses/, https://www.finextra.com/blogposting/18496/remaining-challenges-of-blockchain-adoption-and-possible-solutions, https://www.ibm.com/blogs/blockchain/2018/02/top-five-blockchain-benefits-transforming-your-industry/, Reyna, Ana, et al. "On blockchain and its integration with IoT. Challenges and opportunities." *Future generation computer systems* 88 (2018): 173-190

High Level Architecture Of the proposal

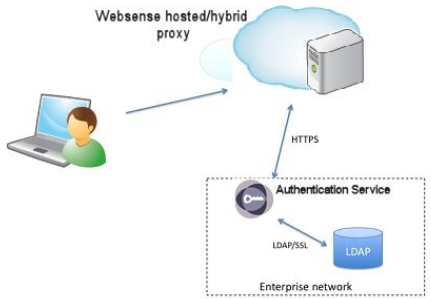


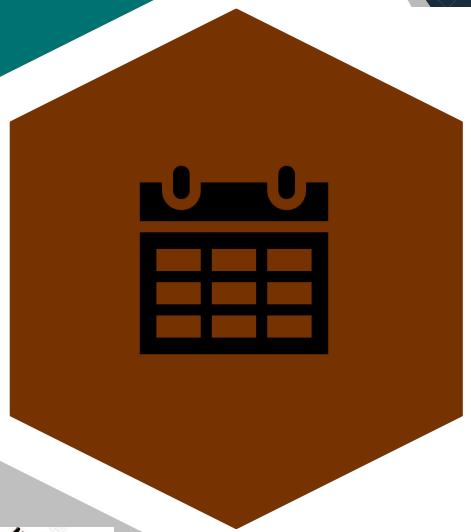
SIEMENS Healthineers

Artificial Intelligence

Demographic surveillance

Authentication services



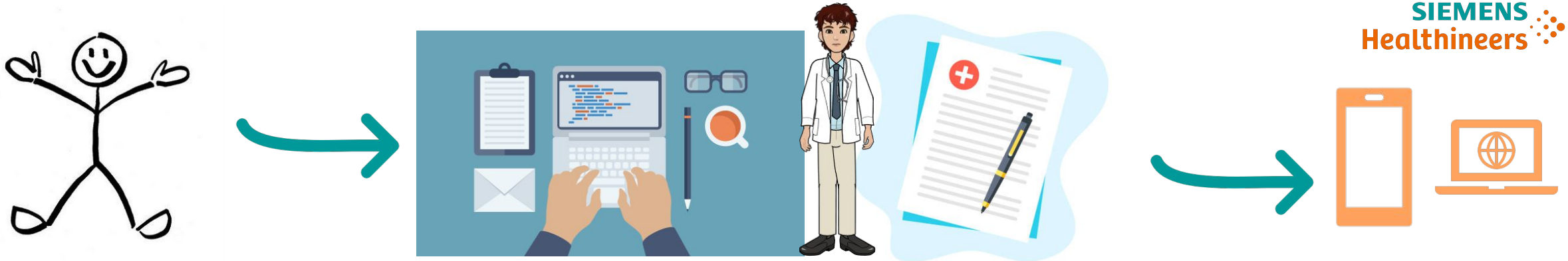


Automatic Scheduling

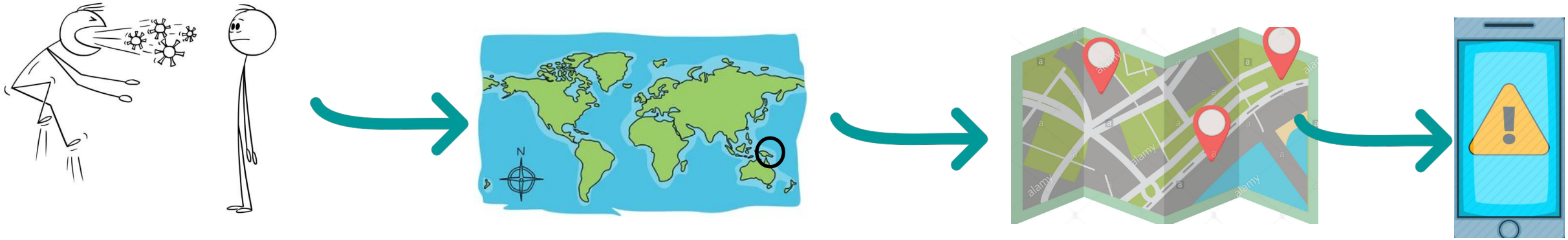
EHR Services

Health passport

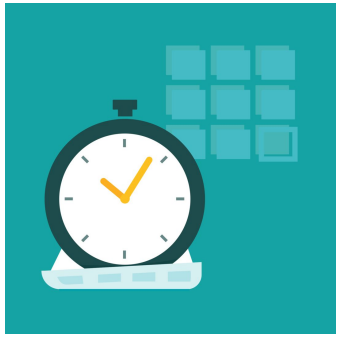
Innovation Think Tank
Proactively drive innovation to improve human life

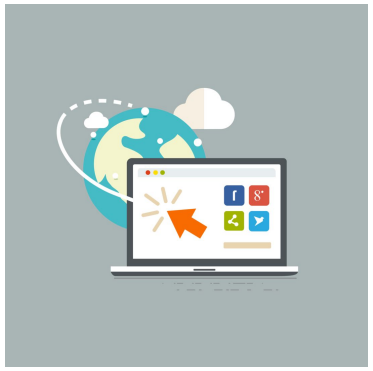


Mobile app/website health record management – all the medical data and records are stored in cloud and can be accessed
by both the patient and the assigned doctor through an app or website

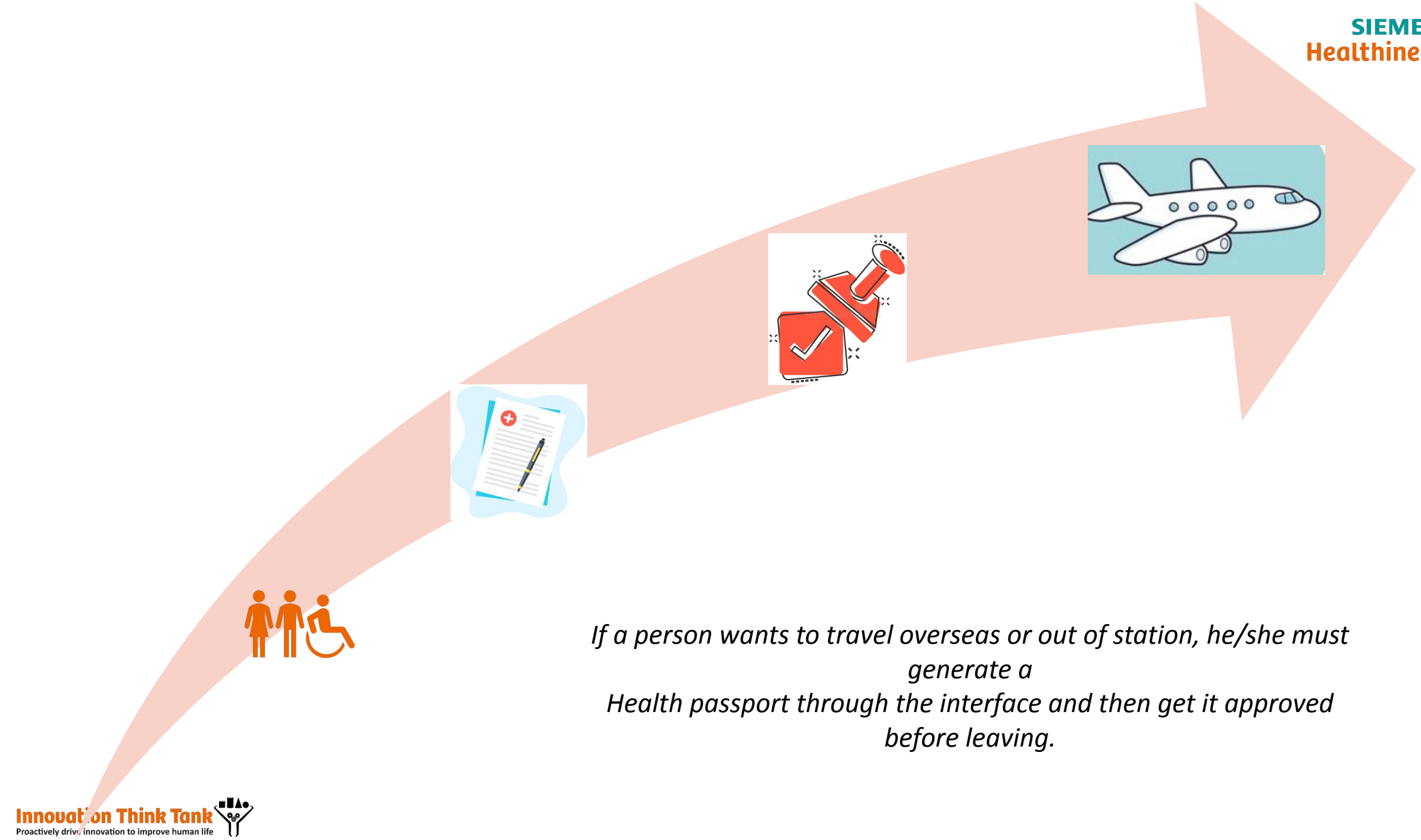


Demographic surveillance system for infectious diseases – data collected from the infected person must be used to alert
new people when they enter highly contaminated areas

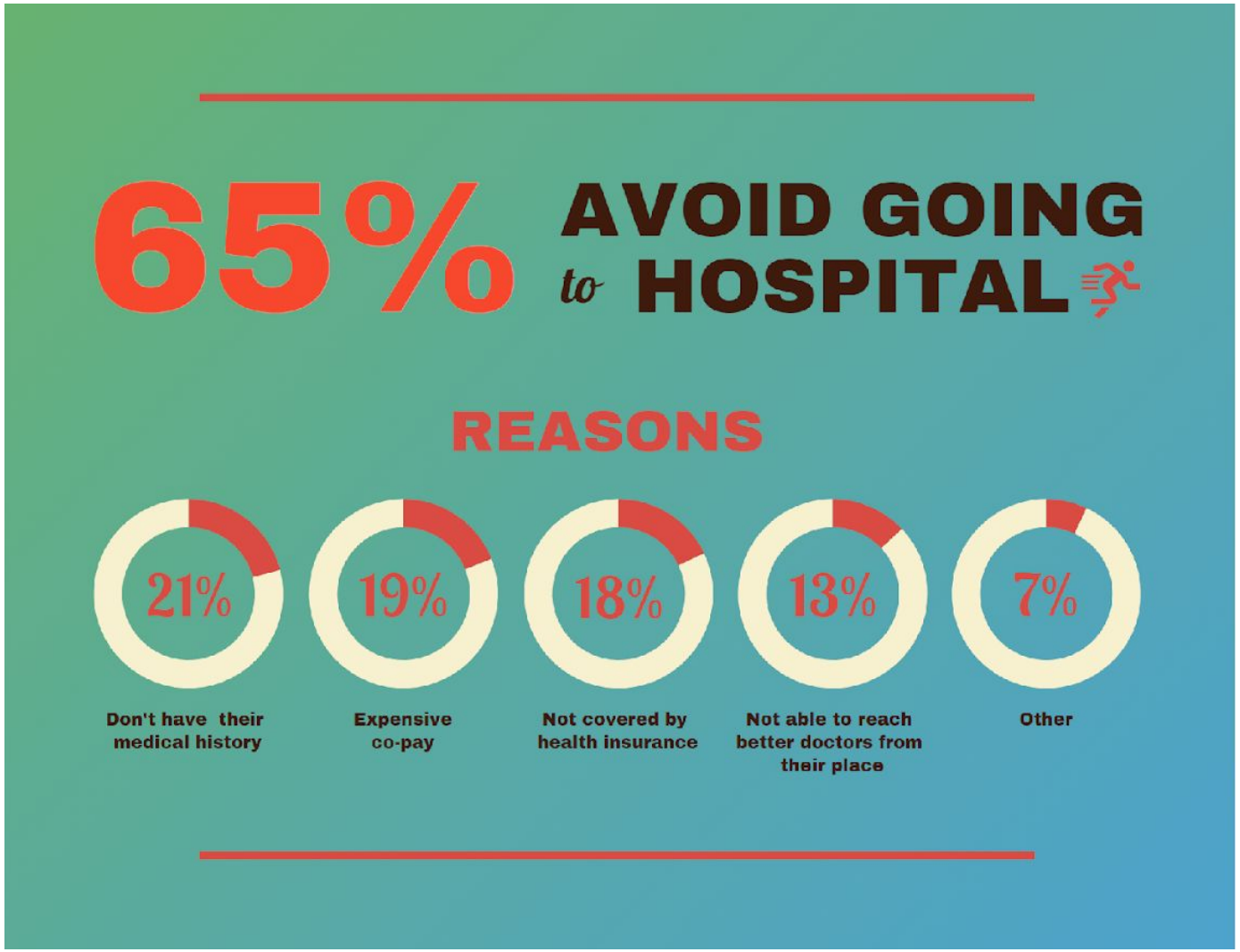




A person who needs to visit a doctor
has to schedule an appointment in this app
and has to reach on time to meet the doctor



If a person wants to travel overseas or out of station, he/she must generate a
Health passport through the interface and then get it approved before leaving.



So basically most of these problems can be solved by our interface.

Summary

- There needs to be a proper technological system to counter any infectious diseases. To address this, we need to take in various technological investments and build a system that can ensure such harshened and unprepared response isn't in play during a possible infectious disease breakout.
- Thus, we have addressed this issue by proposing a proper countering mechanism both before a pandemic and during a pandemic.
- A data warehouse that is linked to a unique id generates the health profile of the patient and stores the medical history of that patient.
- With the demographic surveillance we aim to counter the infection by analyzing abrupt rise in sickness or spread of disease. The application shall alert and restrict movements along such zones
- An automatic scheduling system – to address the needs of patients in outpatient zone – it schedules an appointment which automatically is rescheduled if you don't make it on time and to avoid unnecessary crowding OTP operated doors felicitate the movement through the rooms.
- Health passport has been proposed to allow travel of people whose medical history is known and amidst a pandemic their history of infection/testing and immunization is revealed to the destination country.
- Thus, addressing the various demands we have proposed a solution to counter the spread of the infectious disease.

Innovation Think Tank
Proactively drive innovation to improve human life

Inadequacy in safety and sterilisation

INFRASTRUCTURE

SIEMENS Healthineers

INDEX

BACKGROUND ANALYSIS

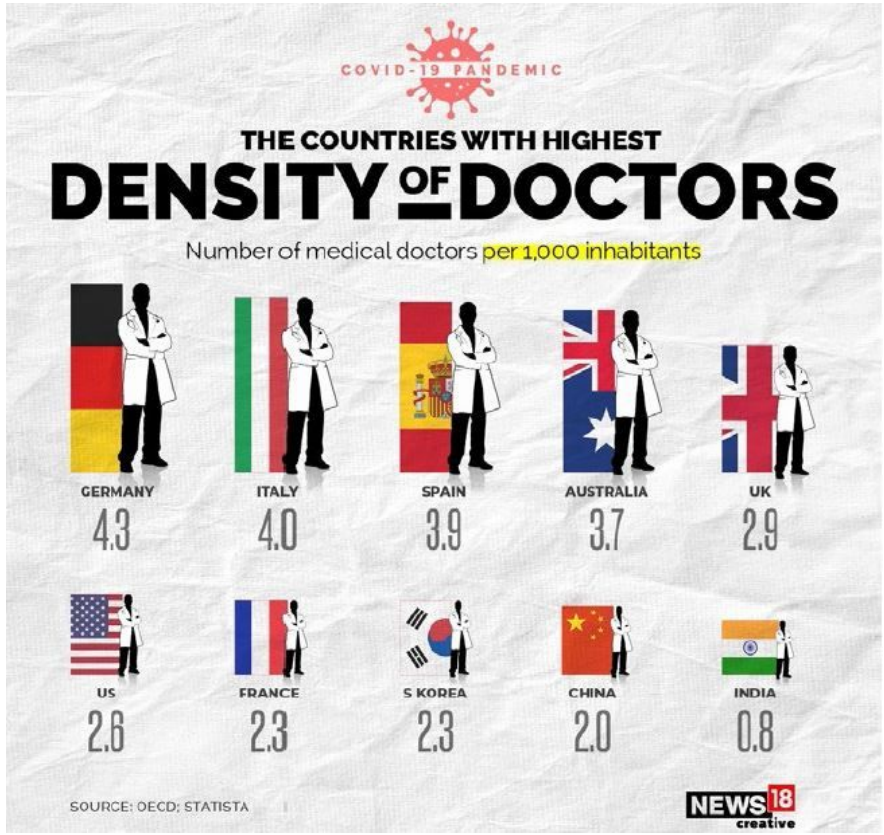
“Many doctors in the city were asked to vacate their rented homes by their owners… one owner said that we were DIRTY… Did I study 14 hours a day for this” – House Surgeon, MGM Hospital, Warangal, Telangana

“HEALTH WORKERS SAFETY: A PRIORITY FOR PATIENT SAFETY”

Physical Risks

Health workers are at the forefront of the Covid-19 outbreak response and as such are exposed to hazards that put them at risk of infection. The COVID-19 pandemic has highlighted huge global challenges and has only increased the daily risks faced by health workers in delivering essential health care services to patients – infection, accidents, violence, illness and even death. Recognizing the professionalism and dedication of the frontline medical soldiers and invest greater resources to protect them from the risk they face in their workplace.

Their dedication towards helping the patients selflessly hasn’t been noticed by the mass who have been taking them for granted. This is placing health workers at unnecessary risk of infection, especially as we know that a large number of people infected with COVID-19 are asymptomatic.

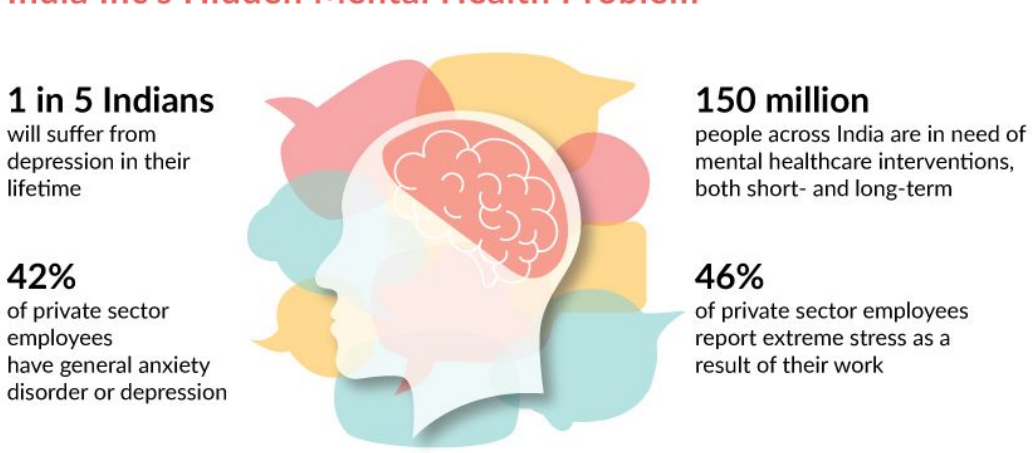


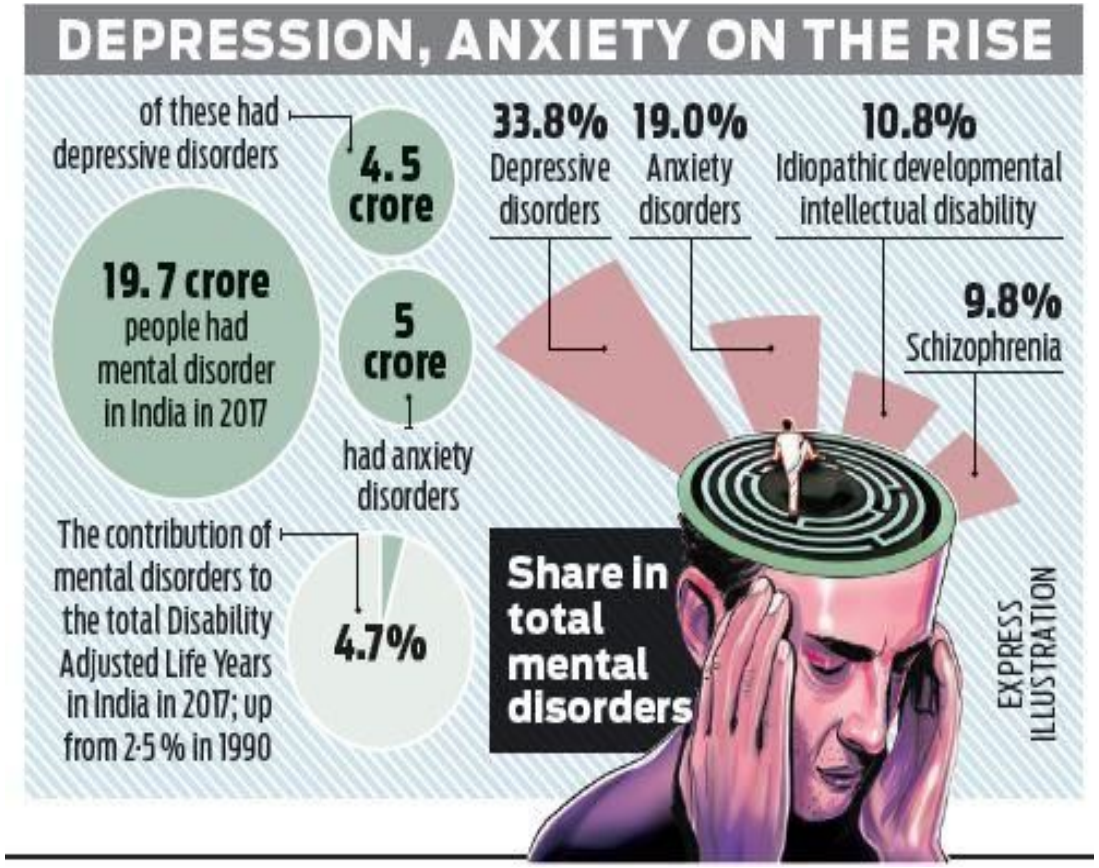
Added Psychological Stress

In addition to physical risks, the pandemic has placed extraordinary levels of psychological stress on health workers exposed to high-demand settings for long hours, living in constant fear of disease exposure while separated from family and facing social stigmatization.

WHO also highlighted an "alarming rise" in reports of verbal harassment, discrimination and physical violence among health workers in the wake of COVID-19.

They have had to bear with assaults and armed attacks, physical and psychological threats, denial of services, eviction from their homes, and stigma, obstructions and cyber attacks.



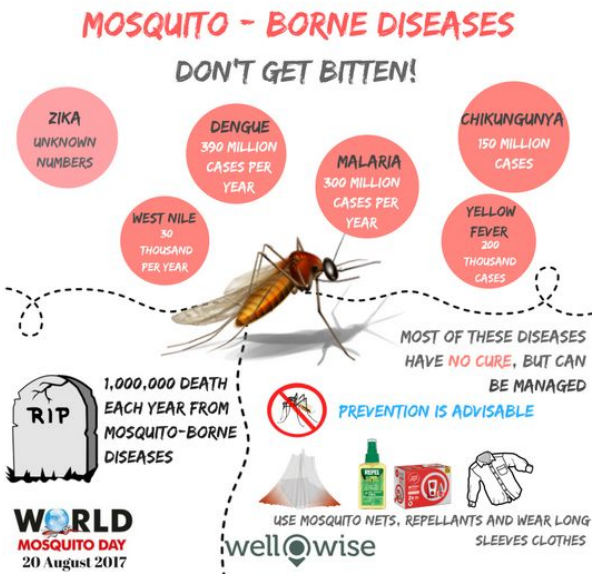


Unavailability of Bio-Medical Instruments

Even though the advancement and boom in the wearable sensors sector, a huge part of the world's community hasn't been able to find its usage in the medical sectors. No such equipment has been implemented with a full support to constantly monitor the vitals and symptoms of the frontline medical heroes. During any infectious outbreak or even after knowing the spread of any communicable disease the only thing that separates them with the infected patient is a thin layer of PPE kit.Health leaders need to promote an open and transparent culture of safety in which incidents are promptly reported and staff receive appropriate training on infection prevention and control.

Healthcare-associated or hospital-acquired infections (HAIs) are infections that people get while they are receiving care for another condition. The source of these infections can be other patients, staff, visitors, or equipment, according to the agency. They can happen in any health care facility. One of the most important factor which we forget during pandemics is the existing crisis of transmission of the existing viruses especially Mosquito bound pathogens which according to a fact is considered as the epitome of human extinction since it has killed more human beings than any other infectious virus outbreak.

Ultraviolet germicidal irradiant devices are regularly used in water purification, food manufacturing and processing, and many others. Various studies have proven UVC light is effective at killing such pathogens as Ebola, Smallpox, HIV, Staph, Influenza, and many others. Sterilisation of the instruments and the rooms is really necessary to remove the factor of spreading of infections through contact.



Health leaders need to promote an open and transparent culture of safety in which incidents are promptly reported and staff receive appropriate training on infection prevention and control.

"Health for All by All – "Speak up for health worker safety!"

Brief Introduction

SIEMENS Healthineers

WEARABLE SENSOR (EMG OR Electromyogram)

The human body is a wonder of nature. The functioning of human body is an intriguing and fascinating activity. Motion of the human body is a perfect integration of the brain, nervous system and muscles. It is altogether a well-organized effort of the brain with 28 major muscles to control the trunk and limb joints to produce forces needed to counter gravity and propel the body forward with minimum amount of energy expenditure.

The EMG signal is a biomedical signal that measures electrical currents generated in muscles during its contraction representing neuromuscular activities. The nervous system always controls the muscle activity (contraction/relaxation). EMG signal acquires noise while traveling through different tissues. Moreover, the EMG detector, particularly if it is at the surface of the skin, collects signals from different motor units at a time which may generate interaction of different signals. The shapes and firing rates of Motor Unit Action Potentials (MUAPs) in EMG signals provide an important source of information for the diagnosis of neuromuscular disorders.

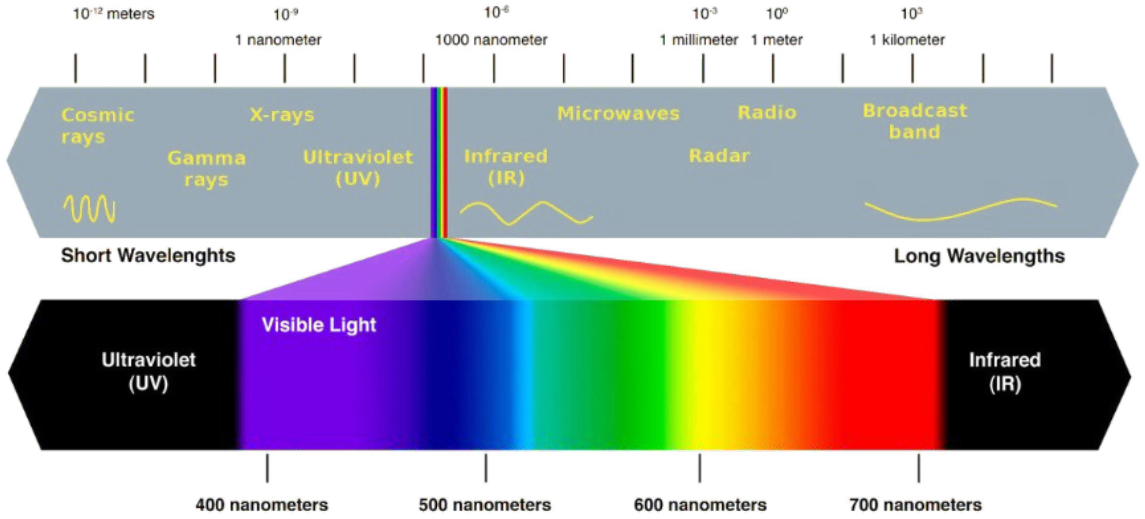
Once appropriate algorithms and methods for EMG signal analysis are readily available, the nature and characteristics of the signal can be properly understood and hardware implementations can be made for various EMG signal related applications. Electromyography (EMG) signals can be used for clinical/biomedical applications, Evolvable Hardware Chip (EHW) development, and modern human computer interaction. EMG signals acquired from muscles require advanced methods for detection, decomposition, processing, and classification.

Useable energy of the signal is limited to the 0 to 500 Hz frequency range, with the dominant energy being in the 50 - 150 Hz range.

ULTRAVIOLET LIGHT

UV light is a reliable, well-studied antimicrobial technology. It works primarily by destroying the DNA inside bacteria, viruses and fungi. The high-energy portion of the UV spectrum called UV-C is most effective. UV-C light has been used for decades to disinfect industrial surfaces and sanitize drinking water. It is especially advantageous for use in hospitals because it kills the spore-forming bacterium Clostridium difficile, which is a major source of hospital-acquired infections.

UV light in the range of wavelengths between 200 and 300 nm is capable of inactivating microorganisms, such as bacteria and viruses, thus disinfecting both air and solid surfaces**.** Often, chemical disinfectants are not enough to remove the bacteria and viruses found in hospitals and other contamination prone environment. Rapid decontamination of the used patient-care beds and hospital rooms before admission of subsequent occupants is a major requirement in hospitals in view of the limited availability of beds. Coronavirus is sensitive to UVC light, as in the case of other viruses and bacteria. The germicidal effects of UVC irradiation with a peak intensity at 254 nm results in cellular damage of the virus, thereby inhibiting cellular replication. Unlike chemical approaches to disinfection, UV light provides rapid, effective inactivation of microorganisms through a physical process.



Prototypes

Physicians, Nurses, Specialists, Practitioners, Physical Therapists, Pathologists

Listen to us!

We bring you our own revolutionary biomedical robot which will bring a difference in your lives.

Your Safety has been our utmost Priority.

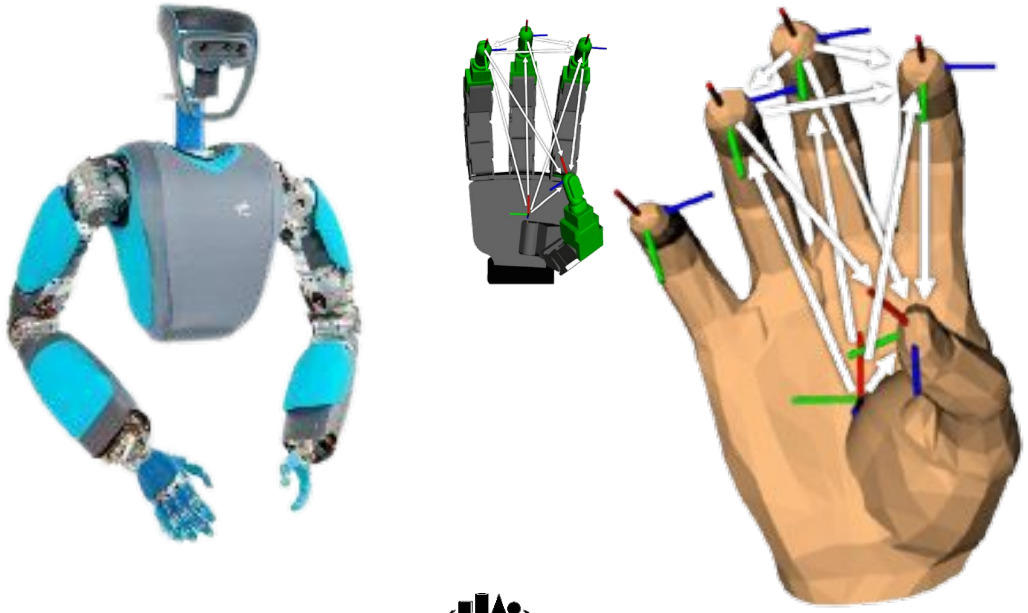
In order to provide a contactless solution where we want to safeguard the frontline medical soldiers from any sort of communicable infectious disease from the patient, we present you a solution in the form of biomed robot named “MyoUV”. According to our research this is the first robot comprising of ‘UV disinfection mechanism’ along with its prosthetic hands controlled and operated by the ‘Electromyography sensor’.

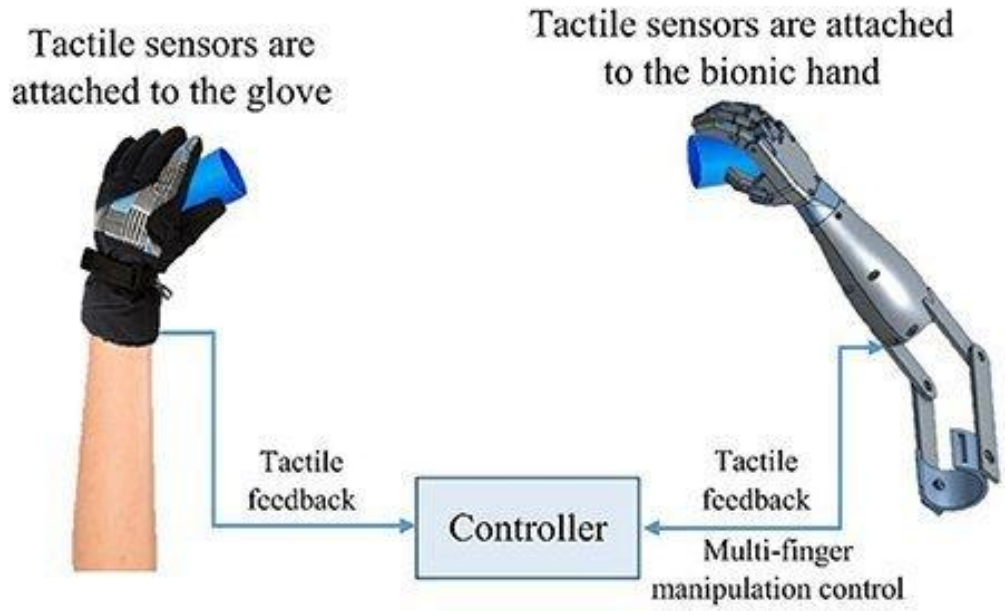
Who is the User?

The user is the concerned Physician who will be wearing an Electric Myo Armband on his/her forearm. Our proposal also comprises to keep the patient along with the robot in the isolation ward wherein we’ll have a separate section for the physician who is at a distance from the patient separated by a glass or a window to avoid any kind of transmission of diseases.

How does it Work?

The user is requested to wear the Electro Myo Armband on the upper arm where the electrodes for more precision elongates till the forearm muscles. The Electric Myo Armband comprises of a number of EMG sensors or known as muscle sensors, Orientation sensor for gestures, Bluetooth modules for connection and several batteries for powering it up. Here, pattern recognition plays a key role in order to orient the prosthetic hands of the robot in the same way as the user commands it to do by performing certain gesture in his/her own hand by being at the other side of the glass. Myoelectric control systems can be classified as a pattern recognition control system and a non-pattern recognition control system. The non-pattern recognition control includes onset analysis, proportional level control and threshold level control.
The human upper limb has three sections the hand, forearm and arm. For the movement of each section, coordinating the relation of the nervous system, musculoskeletal systems and its surroundings are necessary. To perform various actions the electrodes which the user has been attached to gives several degrees of freedom. These coordinated movements are always redundant and can be beneficial to perform complex tasks. When it comes to an artificial hand, all such control features of the normal hand should extensively match.



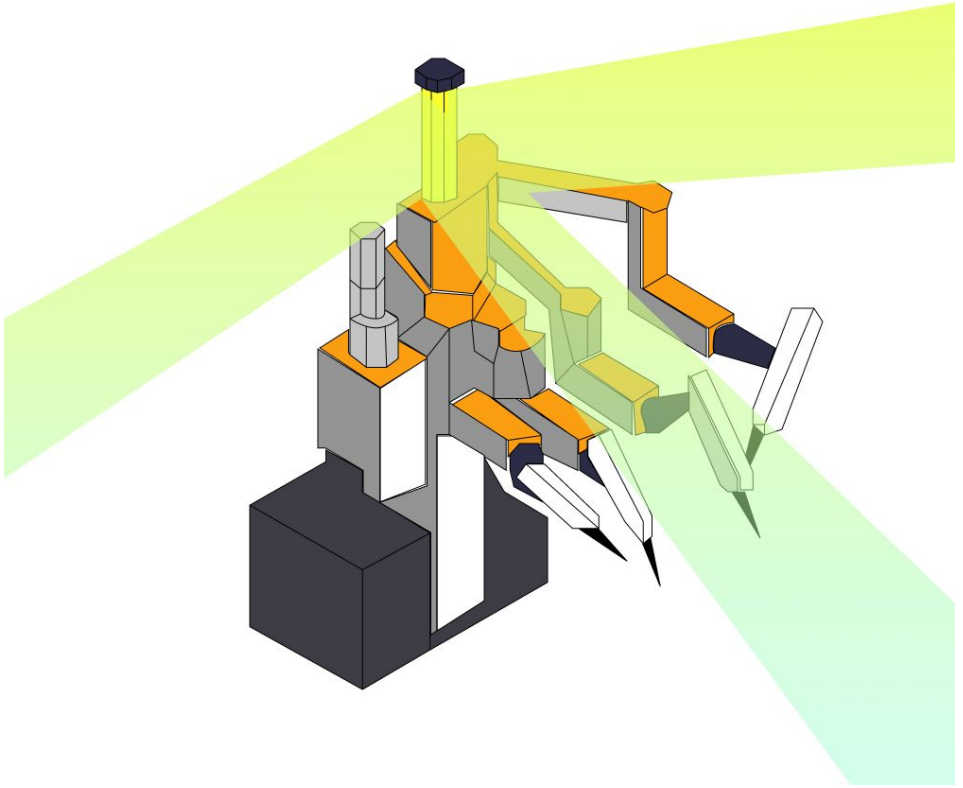


MyoUV

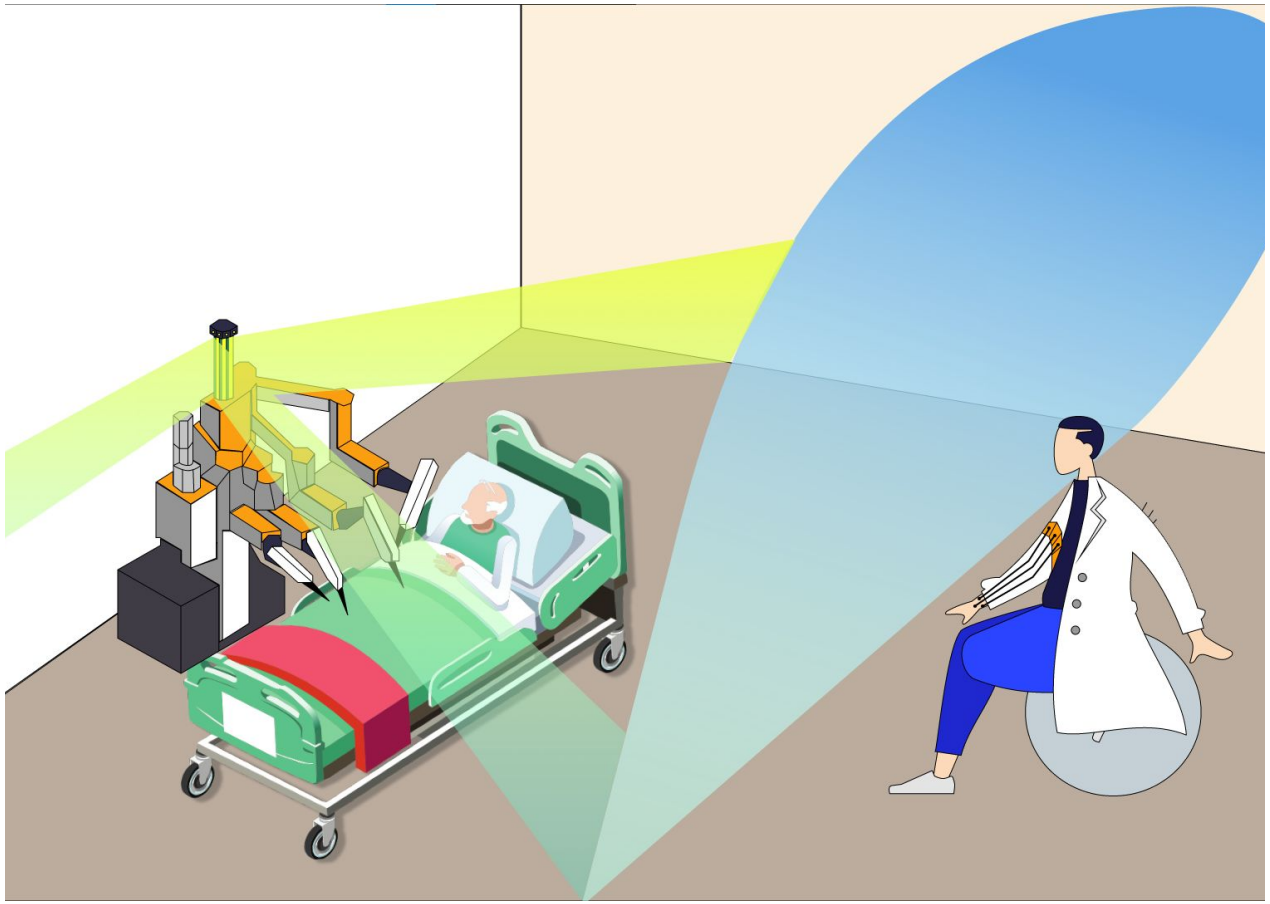
Now, “MyoUV” role is to also sterilise the entire isolation ward using either mercury-UV bulbs that run continuously or xenon UV bulbs that pulse. Mercury UV bulbs primarily emit light at 254 nanomers, while pulsed xenon UV bulbs emit UV light at several different germicidal wavelengths. Further to focus the beam at every part of the isolation ward the rotation the beam takes place along with its movement in the XY co-ordinate axis.

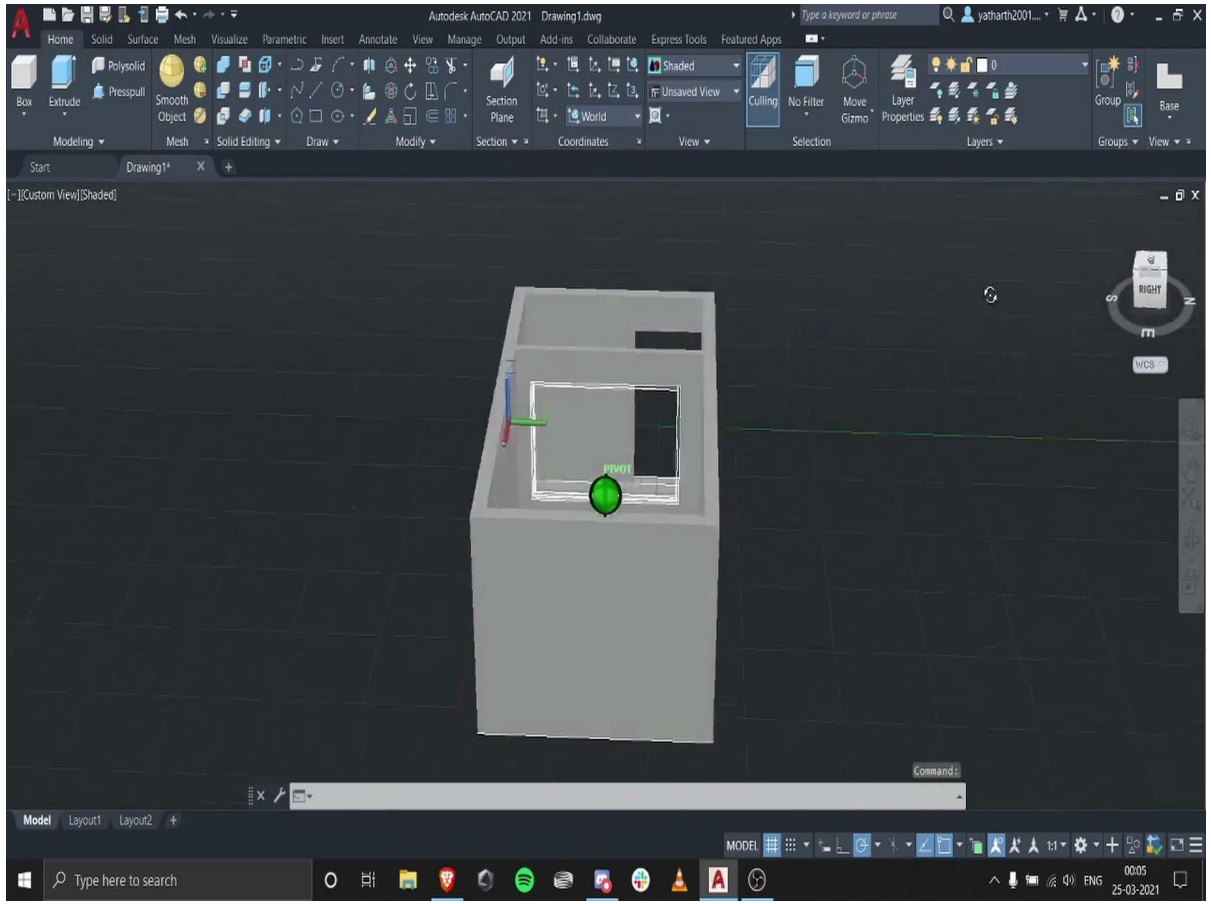
The device is run when the room is empty after a patient discharge and terminal cleaning. The xenon bulb in the device will pulse for 5 min disinfecting an area around the device. During this time the user stays outside the room. UVC light cannot go through safety glasses, walls or windows. However with prolonged exposure UVC could damage eyes so always run the robot in an empty room.

For additional safety there is an orange cone that stays outside of the room and guards at the door as well as caution signs for the door. Inside the room the gray cone watches the entrance to the room and detects motion. Should motion be detected during the pulsing of the light the gray cone will turn the device off you will use the device after you’ve finished cleaning a room but before the bed is made.



A visual demonstration of “MyoUV”





Technology Roadmap

Impact

- The aim was to raise people interest about their health status, improving the quality of care and making use of the new technology capabilities. These devices create a synergy between multiple science domains such as biomedical technologies, micro and nanotechnologies, materials engineering, electronic engineering and information and communication technologies
- A study by Setz and colleagues (2010) showed that even simple electrodermal activity (EDA) sensors have the capacity to identify stress level.
- The COVID-19 crisis has shifted innumerable perceptions regarding daily activities as well as has led to a significant reassessment towards well-being and protection.
- The cost of hospital care is expected to rise from 0.9 percent to 2.4 percent of the budget by 2025, increasing the importance of good business practices and educated professionals in the healthcare industry.

Market Needs

1990	2000	2010	2020	2030
The cost started growing at an exponential rate and the medical procedure started costing around 10000 inr	Healthcare market stood around 45 billion usd.	In terms of global revenue, market research estimates range from $4.65 billion81 to $9.17 billion.82 Firms varied greatly in their projections for 2018, ranging from a conservative $6 billion 83 to an optimistic $30.2 billion.8	Healthcare market in India is expected to reach US$ 193.83 billion by 2020 and US$ 372 billion by 2022 driven by rising income. better health awareness, lifestyle diseases and increasing access to insurance	The wearable medical devices market was valued at USD 19,450 million in 2020 and is expected to reach USD 47,837 million by 2026

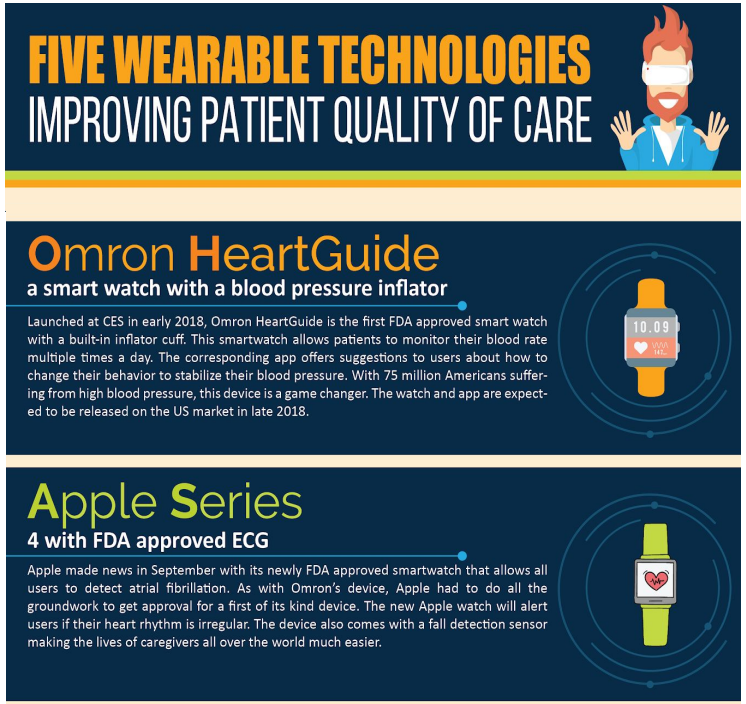
Challenges

1990	2000	2010	2020	2030
Difficulty in coordination and integrattion of various tasks performed	Beyond the problems health care providers face in determining which devices and equipment may be non-compliant, there is also the very real threat that payments will be delayed because many government systems have yet to be remediated	Facing the new e-technology will bring lots of problems leading to overpriced of medical drugs and equipments	The exposure grows due to the increased amount of data from medical devices becoming integral to patient care. It has long been known that medical devices are vulnerable due to manufacturer negligence in providing adequate security protections and the use of legacy equipment by healthcare providers.	

Technology Breakthroughs

1990	2000	2010	2020	2030
Cochlear Implants	Ventricular Assist Device	Sidne Voice activation system	Ireland developed a "remote non-intrusive patient monitoring" platform which was used to evaluate the quality of the data generated by the patient sensors	Robotic exoskeletons for paraplegics	MHealth	UV Disinfection	Portable healthcare camps inspired from Origami
Pulse Oximeter	Medical Lasers	OxyMask		Virtual Reality for Surgeons	Wearable Technologies	Augmented Reality
Laryngeal Mask Airway	da Vinci Surgical System	Impella 2.5 Circulatory support system	Development and Introduction to Cloud, Mobile and Big Data	The "internet of medical things" (IoMT) refers to the network that connects smart medical devices via the internet.	RFID implants for recreational purposes
Safety Needles and Syringes	WHO adopted the ICD coding standard	Adaptive Artificial Knee	3D printing technology introduced for using bioprinting, growing cells from a patient's stem cells to, for example, print skin to encourage faster burn or wound healing.	Brain-computer interfaces bring hope for the paralyzed	Drone Technology for transferring of supplies

Additional content about the proposal

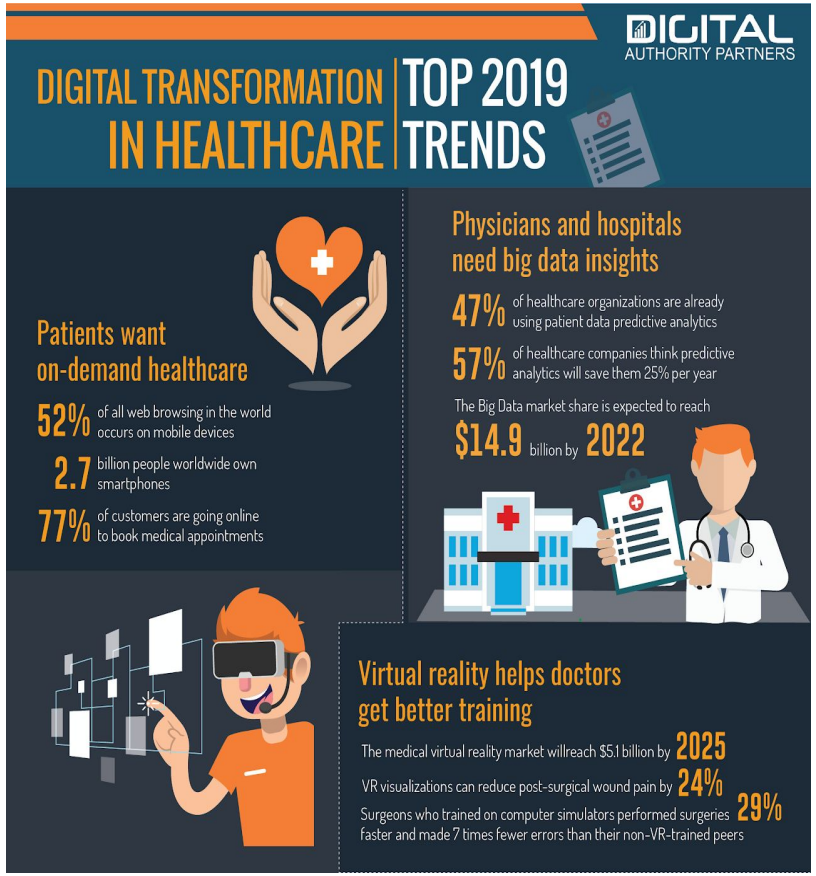


Electromyo Arm Band (The Hands) a part of MyoUV performing all the main tasks of diagnosis and therapy will surely bring a change in the medical health care sector.

The armband is entirely controlled and operated by the physician wherein the signals captured are further amplified and filtered to get a precise and accurate output after the contraction or relaxation of the muscles take place.

Wearable technology is the future for the frontline medical soldiers who deserve a technology which will take care of them too.

Summary

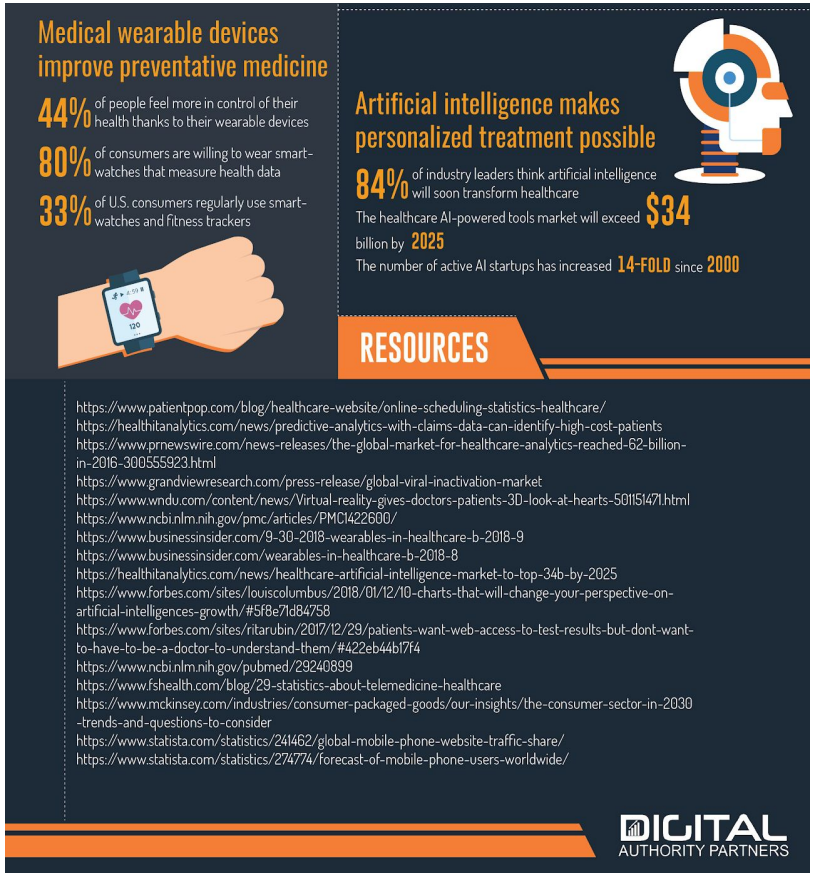


Spending hours of research brought us to a stage of developing an idea relating the two most powerful weapons in the pandemic scenario which can bring a difference in the lives of the Frontline Medical Soldiers and to the Citizens as well.

MyoUV being a robot has its own hands and brain. MyoUV is a fighter against the deadly pathogens but take care that no humans are allowed in the vicinity when UV disinfection starts in the room.

The hands of MyoUV are controlled by the electromyography sensor which is attached to upper arm of the physician who controls and operates each and every action of the prosthetic or robotic hands of the robot.

Advancement in Wearable Technology is the future and we being the budding engineer in process will surely try to bring a change.



Innovation Think Tank
Proactively drive innovation to improve human life

SIEMENS Healthineers

National Pandemic Preparedness Plan

INFRASTRUCTURE

INDEX

Background Analysis

To combat #COVID19, the Indian railways has converted train coaches into isolation wards for COVID-19 patients - offering clean, sanitised and hygienic surroundings for the patients to comfortably recover. - tweeted by United Nations in India

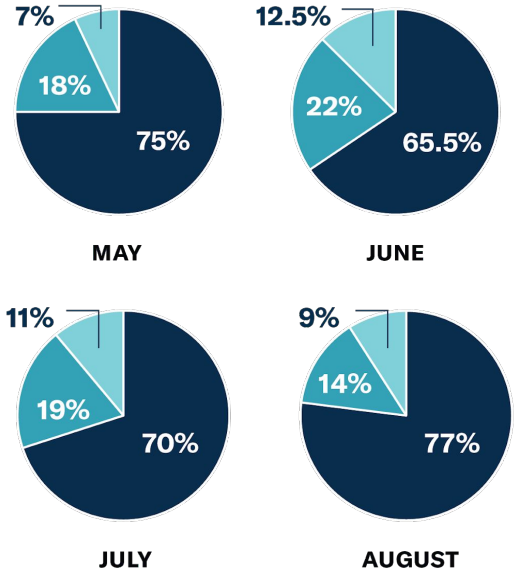
WHO GUIDANCE

Influenza pandemics are unpredictable but recurring events that can have serious consequences for human health and economic well-being worldwide. Advance planning and preparedness to ensure the capacities for pandemic response are critical for countries to mitigate the risk and impact of a pandemic. Over the years, WHO has provided up-to-date evidence-based guidance to support countries to develop pandemic preparedness plans and the capacities to prevent, prepare for and respond to the threat of a pandemic. WHO subsequently updated this guidance, and finalized it in 2017 as Pandemic influenza risk management: a WHO guide to inform & harmonize national & international pandemic preparedness and response

1. This latest guidance provides risk-based strategies and approaches to pandemic influenza preparedness and response, and encourages countries to develop sustainable and resilient pandemic preparedness plans. To make it easier to apply the strategies and approaches in the pandemic preparedness practice, in January 2018, WHO published an updated pandemic influenza preparedness checklist – A checklist for pandemic influenza risk and impact management: building capacity for pandemic response
2. The checklist is a practical tool to ensure that countries take into account all the essential pandemic response capacities when planning for national pandemic influenza preparedness. The aim is to ensure that, when countries develop or update a plan, the objectives are clear and the essential steps and actions are taken; this is imperative if the plan will be guiding pandemic preparedness and response practices. In countries that are in or preparing to start the planning process for addressing broader health security threats, e.g., the development of National Action Plan for Health Security (NAPHS), it is crucial to consider linking the two planning processes

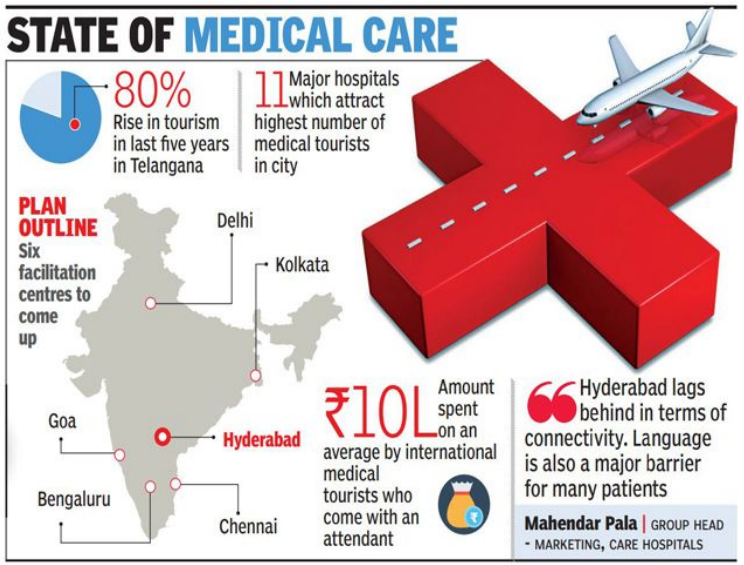
PROBLEMS IN HEALTH CARE FACILITY

In recent flu seasons, it has been reported that hospital emergency departments have reached their limits and that there is little room for a surge in patients in either emergency rooms or inpatient beds. A grim picture is predicted of a significant surge in the need for additional health-care resources, which our nation currently lacks. It is expected that there would be serious shortages of health-care facilities, equipment, pharmaceuticals, and personnel. The public health system and hospitals will be quickly overrun if even some of the estimated number of people become sick. It is important to realize that victims of this disease will, by default, need to be cared for in home-care settings, and we must plan accordingly.



ACCESSIBILITY PROBLEMS

Essential medicines are those drugs that satisfy the priority healthcare needs of the population. As a result of the surge in the pandemic, which led to the inevitable lockdown of the economy across affected countries, there has been a noticeable decrease in production and exportation of raw materials as well as finished products (drugs) across different countries. These greatly affected the ease of access to these medicines by the consumers who need them either for treating acute ailments or for the management of chronic diseases. There have been reports that some pharmacies have closed due to the pandemic, and widespread illness, quarantines, and social distancing measures may increasingly disrupt pharmacy access. In addition, given a surge in demand for certain types of health care, there will be heightened need for many medicines such as those used to treat respiratory disease and critical illness.



Innovation Think Tank
Proactively drive innovation to improve human life

Brief Introduction

SIEMENS Healthineers

CONCEPT of ORIGAMI

Nature has always given us the opportunity to learn and explore from them. One such concept whose origin dates back to 1603 and much before, is paper folding also known as Origami. While we think of origami as art, it increasingly is being used by companies and researchers in space, medicine, robotics, architecture, public safety and the military to solve vexing design problems, often to fit big things into small spaces. An origami technique called Miura-ori has been used to demonstrate how paper can be folded to produce stiff but flexible structures. With the concept of paper folding being increasingly recognized as an area of engineering research it is being seen as a means to develop deployable and reconfigurable engineering systems that take advantage of their flexibility as the thin sheets can be bent and twisted easily, and also folded flat for storage and transport.

Such assemblages can be deployed through a single flexible motion, and are also significantly stiffer for any other type of bending or twisting movement. Several subdisciplines of origami that are useful in mechanical engineering have emerged over the years. *Orimimetrics* is the application of folding to solve engineering problems.*Rigid origami* considers creases as hinges and models the material between creases as *rigid*, restricting it from bending or deforming during folding. *Action origami* is concerned with models that have been folded so that in their final, deployed state they can move with one or more degrees of freedom. *Kinematic origami* is designed to exploit relative motion between components of an action origami model. *Kirigami* strays from traditional origami rules by allowing cutting in addition to creases, but provides a manufacturing advantage that is sometimes more suited to engineering applications. In many instances of so-called ‘origami-based devices’, ‘kirigami’ is the more appropriate label. It has found direct application in folding/morphing structures, micro-electromechanical systems, and cellular core structures for energy dissipation

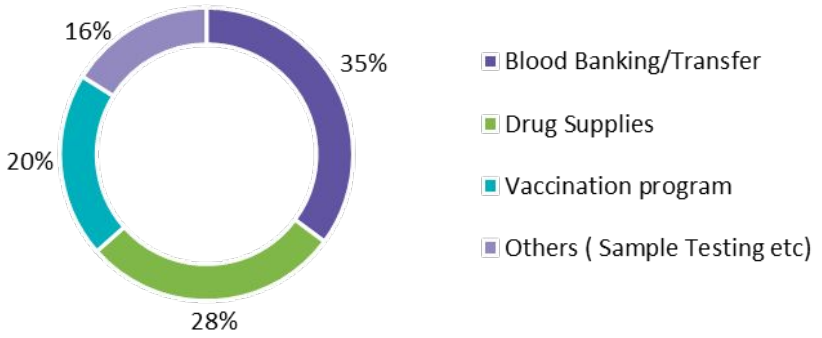
DDS - DRONE DELIVERY SERVICES

During crises like this pandemic, bottlenecks in drug distribution and sample testing can be improved through automation, artificial intelligence, and robotics.Drone operators are providing delivery as a service to healthcare customers. They operate from distribution centers and warehouses stocked with medical commodities such as vaccines, blood units, test kits, and other medical supplies. Once they receive an order, the products are placed in a box and sent via the drone. On average, bigger operators have around 20 to 30 drones at each center, which allows them to simultaneously send more than one package when demand requires it. Additionally, some operators have set up drone stations near hospitals to facilitate fast and secure transport.

With drones having the potential to assist in emergency situations, continued technological advances in medical drones will drive the market demand.Additionally, the use of drones to deliver medicines and vaccines to remote locations is a key step forward in supply chain innovation by bio-pharmaceutical companies.

At high altitude regions of mountains, health infrastructure has been neglected the most and it is also true that the setup of solid healthcare facilities may not be of any use because of the variations in the terrain. Here, drones act as a source for delivering the required drugs to maintain the chain of healthcare facilities provided to each and every citizen.

Figure 1: Application Use of Medical Drones (in %)



Source: Beroe Analysis, marketwatch.com

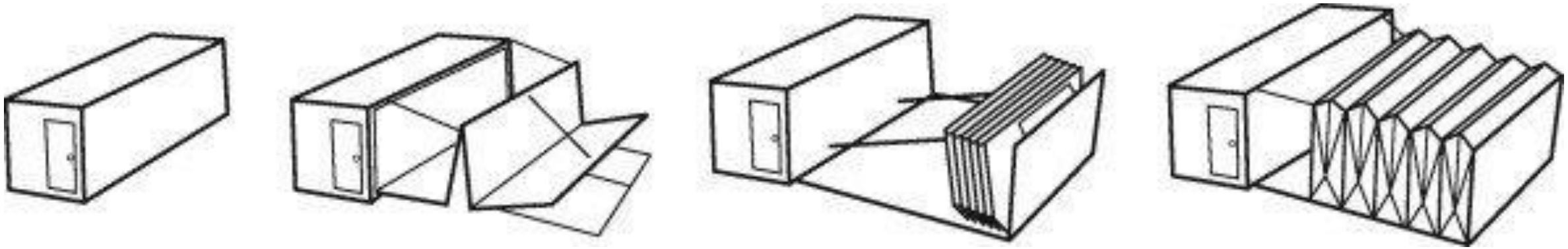
Prototypes

SIEMENS Healthineers

We propose you a new concept of delivery and setting up of health infrastructure named “Origone”.

Setting up of solid structures are now a talk of the past, the future upholds the concept of “Origone”, the world’s first portable and foldable origami based Health Care infrastructure for the purpose of testing and diagnosis of patients where the delivery agents are the flying electronic machines called “Drones” who will be their to your rescue.
Accessibility has never been so easy until now where the drones come to your rescue for transporting and delivering purposes. These unmanned air vehicles may vary their luggage according to their size and shape.

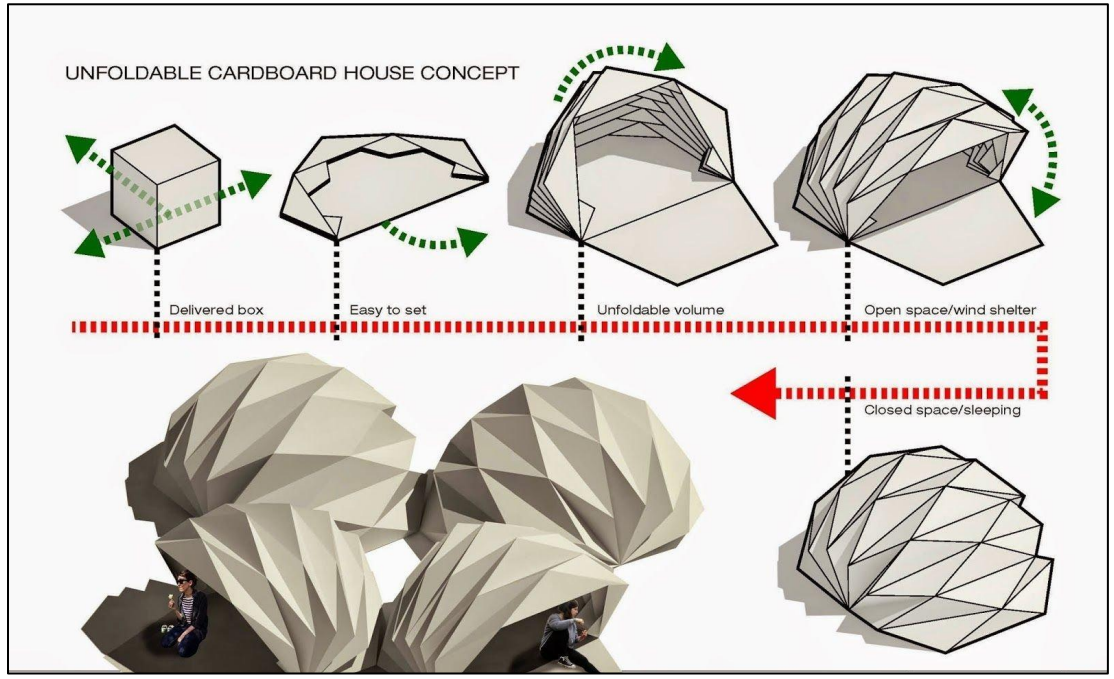
These portable camps can be also setup with a view of isolation wards for short period of time. They can be considered as the key infrastructural change which the future looks upon.

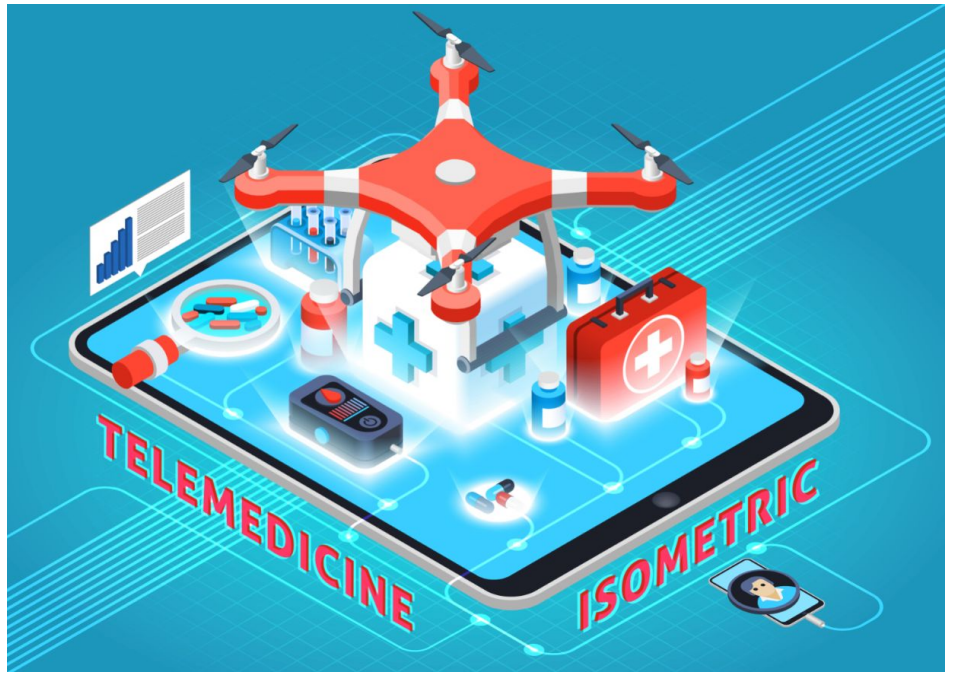


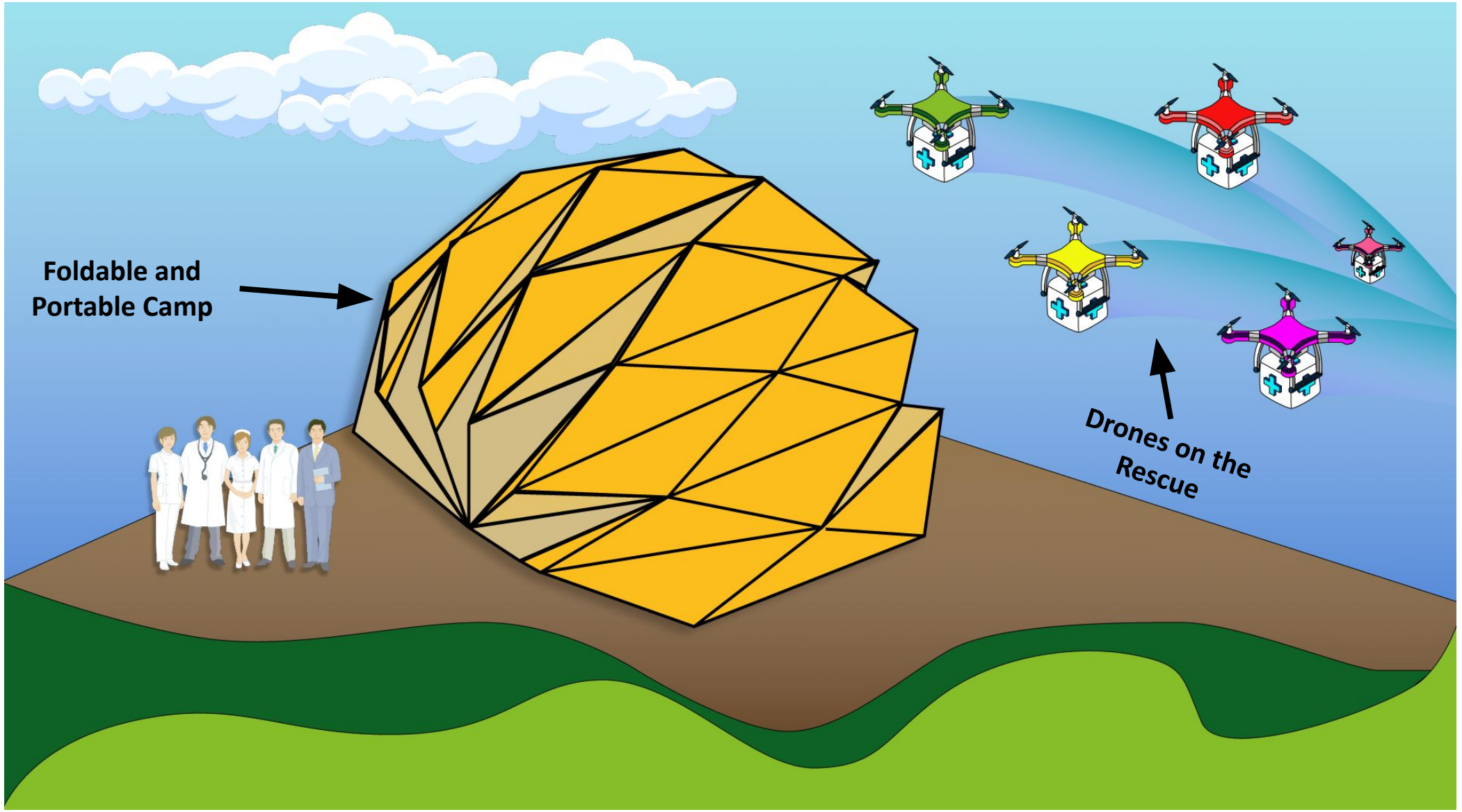
WORKING SCENARIO

Our proposal for “Origone” targets the remote areas and bio-pharmaceutical companies and hospitals too. Instead of building solid structures, the preparedness plan either in pandemic or during the time of epidemic, these camps can be formed from scratch by the concerned authority wherein they can setup whenever they wish and close it whenever they don’t require it.

Now the unmanned air vehicles will be the transporter of the required drugs from the warehouses which are built up near hospitals and travel directly to these portable camps for performing diagnosis and testing for short duration and also setting up separate isolation wards where the patients whose condition is critical can be shifted there avoiding any further contact or transmission to other people.







Technology Roadmap

Impact

- The aim was to raise people interest about their health status, improving the quality of care and making use of the new technology capabilities. These devices create a synergy between multiple science domains such as biomedical technologies, micro and nanotechnologies, materials engineering, electronic engineering and information and communication technologies
- A study by Setz and colleagues (2010) showed that even simple electrodermal activity (EDA) sensors have the capacity to identify stress level.
- The COVID-19 crisis has shifted innumerable perceptions regarding daily activities as well as has led to a significant reassessment towards well-being and protection.
- The cost of hospital care is expected to rise from 0.9 percent to 2.4 percent of the budget by 2025, increasing the importance of good business practices and educated professionals in the healthcare industry.

Market Needs

1990	2000	2010	2020	2030
The cost started growing at an exponential rate and the medical procedure started costing around 10000 inr	Healthcare market stood around 45 billion usd.	In terms of global revenue, market research estimates range from $4.65 billion81 to $9.17 billion.82 Firms varied greatly in their projections for 2018, ranging from a conservative $6 billion 83 to an optimistic $30.2 billion.8	Healthcare market in India is expected to reach US$ 193.83 billion by 2020 and US$ 372 billion by 2022 driven by rising income. better health awareness, lifestyle diseases and increasing access to insurance	The wearable medical devices market was valued at USD 19,450 million in 2020 and is expected to reach USD 47,837 million by 2026

Challenges

1990	2000	2010	2020	2030
Difficulty in coordination and integrattion of various tasks performed	Beyond the problems health care providers face in determining which devices and equipment may be non-compliant, there is also the very real threat that payments will be delayed because many government systems have yet to be remediated	Facing the new e-technology will bring lots of problems leading to overpriced of medical drugs and equipments	The exposure grows due to the increased amount of data from medical devices becoming integral to patient care. It has long been known that medical devices are vulnerable due to manufacturer negligence in providing adequate security protections and the use of legacy equipment by healthcare providers.	

Technology Breakthroughs

1990	2000	2010	2020	2030
Cochlear Implants	Ventricular Assist Device	Sidne Voice activation system	Ireland developed a "remote non-intrusive patient monitoring" platform which was used to evaluate the quality of the data generated by the patient sensors	Robotic exoskeletons for paraplegics	MHealth	UV Disinfection	Portable healthcare camps inspired from Origami
Pulse Oximeter	Medical Lasers	OxyMask		Virtual Reality for Surgeons	Wearable Technologies	Augmented Reality
Laryngeal Mask Airway	da Vinci Surgical System	Impella 2.5 Circulatory support system	Development and Introduction to Cloud, Mobile and Big Data	The "internet of medical things" (IoMT) refers to the network that connects smart medical devices via the internet.	RFID implants for recreational purposes
Safety Needles and Syringes	WHO adopted the ICD coding standard	Adaptive Artificial Knee	3D printing technology introduced for using bioprinting, growing cells from a patient's stem cells to, for example, print skin to encourage faster burn or wound healing.	Brain-computer interfaces bring hope for the paralyzed	Drone Technology for transferring of supplies

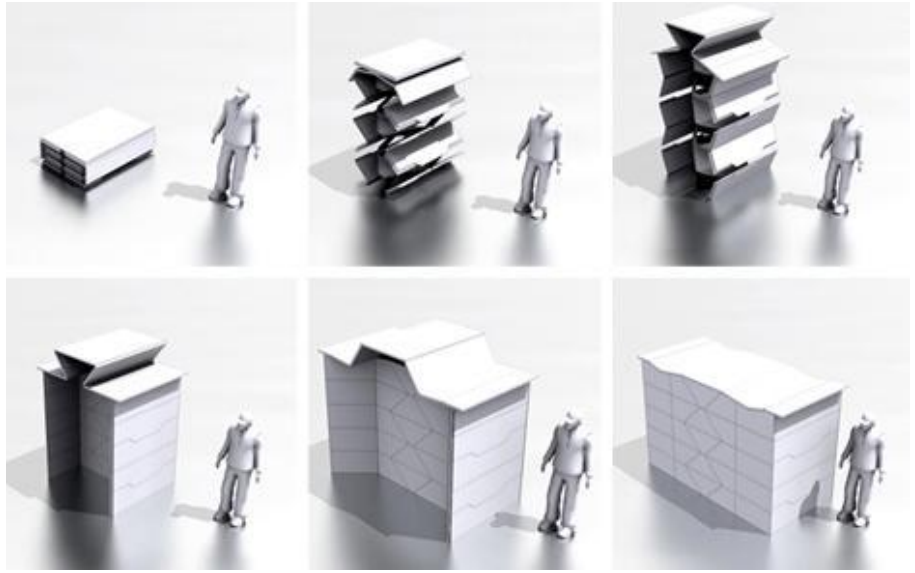
Additional content about the proposal

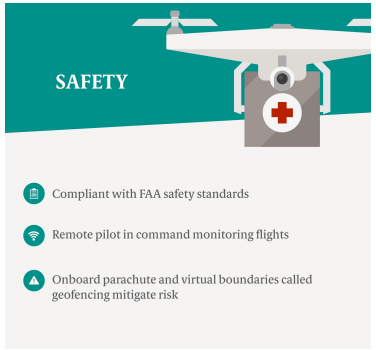
SIEMENS Healthineers

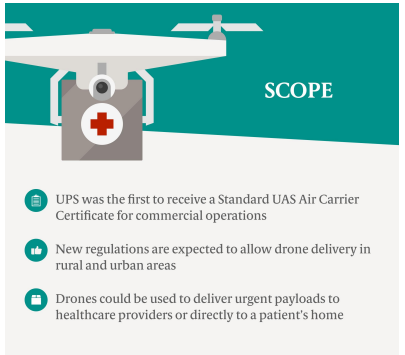
Unmanned Aerial Vehicles are an excellent way to modernize the last mile in medical deliveries and bridge gaps in access. Drones can provide just-in-time resupplies of key medical items, regardless of location. Since some health systems can't afford to keep cold-chain products such as platelets or blood on-site, drones can ensure these supplies are available on demand.

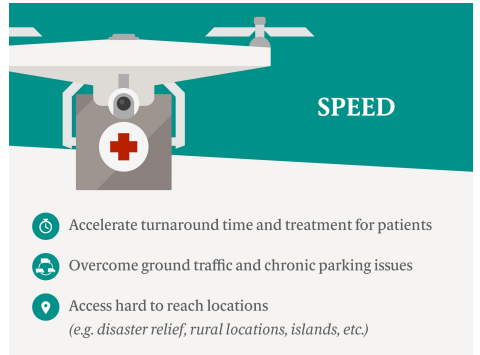
Drones for healthcare logistics have recently seen a range of landmark moments. Citing a case, a University of Maryland drone delivered a kidney that was successfully transplanted into a patient suffering from a serious nephrological condition, the first ever drone delivery of a human organ.

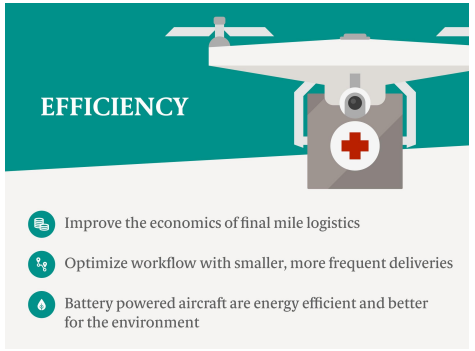
Researchers have explored the possibility of using **origami** designs to improve disposable sterilization covers, cardiac catheterization, stent grafts, encapsulation and microsurgery, gastrointestinal microsurgery, laparoscopic surgical grippers, microgrippers, microfluidic devices, and drug delivery.

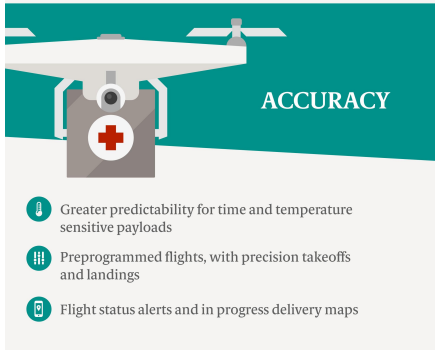












Innovation Think Tank
Proactively drive innovation to improve human life

Summary

After referring and going through more than 30+ research papers and other citations, and also taking in account what professor Sultan Haider told us “You can find Pattern from the Nature”, we came up with the idea of “Origone” (Origami + Drone). Though the concept sounds paper folding but we want to give it a bend towards building up of health care infrastructures which is foldable and also at the same time portable to any place. Building of Infrastructure requires a proper pandemic preparedness plans beforehand with the help of distribution of required medicine and kits to the required station.

The concept of Origone will change the scenario of setting up and distribution of health care infrastructure where the government instead of laying up solid infrastructures could go for something which is Portable Durable and Foldable in the remote locations.