

## A vibrant blue background filled with a dense network of white icons, each enclosed in a circle. These circles are interconnected by a web of thin white lines, creating a sense of global connectivity and digital integration. The icons represent a wide array of concepts: technology (shopping cart, gear, lightbulb, envelope, Wi-Fi, smartphone, camera, house, globe, laptop, car, location pin, speech bubble, butterfly, clock, heart with pulse, ambulance, key, paperclip, lightbulb, thermometer, bird, books, box, fork, knife, pen, sun, cloud, location pin, speech bubble, butterfly, clock, heart with pulse, ambulance, key, paperclip, lightbulb, thermometer, bird, books, box, fork, knife, pen, sun, cloud, location pin), communication (envelope, speech bubble, speech bubble, speech bubble), health (heart with pulse, heart, apple), and general life (house, car, location pin, speech bubble, butterfly, clock, heart with pulse, ambulance, key, paperclip, lightbulb, thermometer, bird, books, box, fork, knife, pen, sun, cloud, location pin). At the bottom center, a dark blue silhouette of a person's head and shoulders is visible, looking upwards towards the network of icons. The overall composition suggests a theme of digital transformation, smart living, and interconnectedness.



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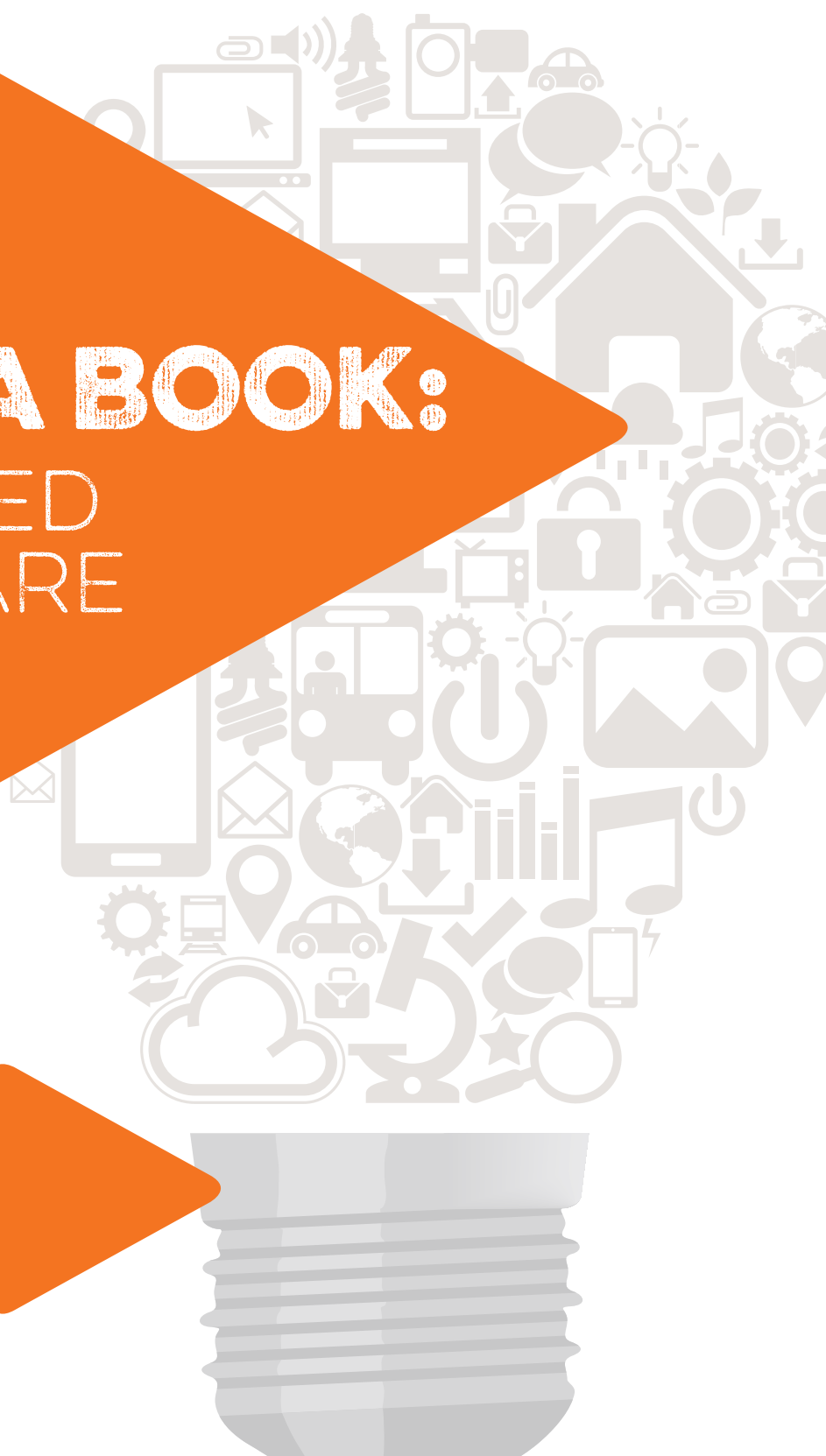


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# CONNECTED HEALTHCARE





# CONNECTED HEALTHCARE

## INCLUSIVE AND CONTINUOUS PRECISION HEALTHCARE SERVICES

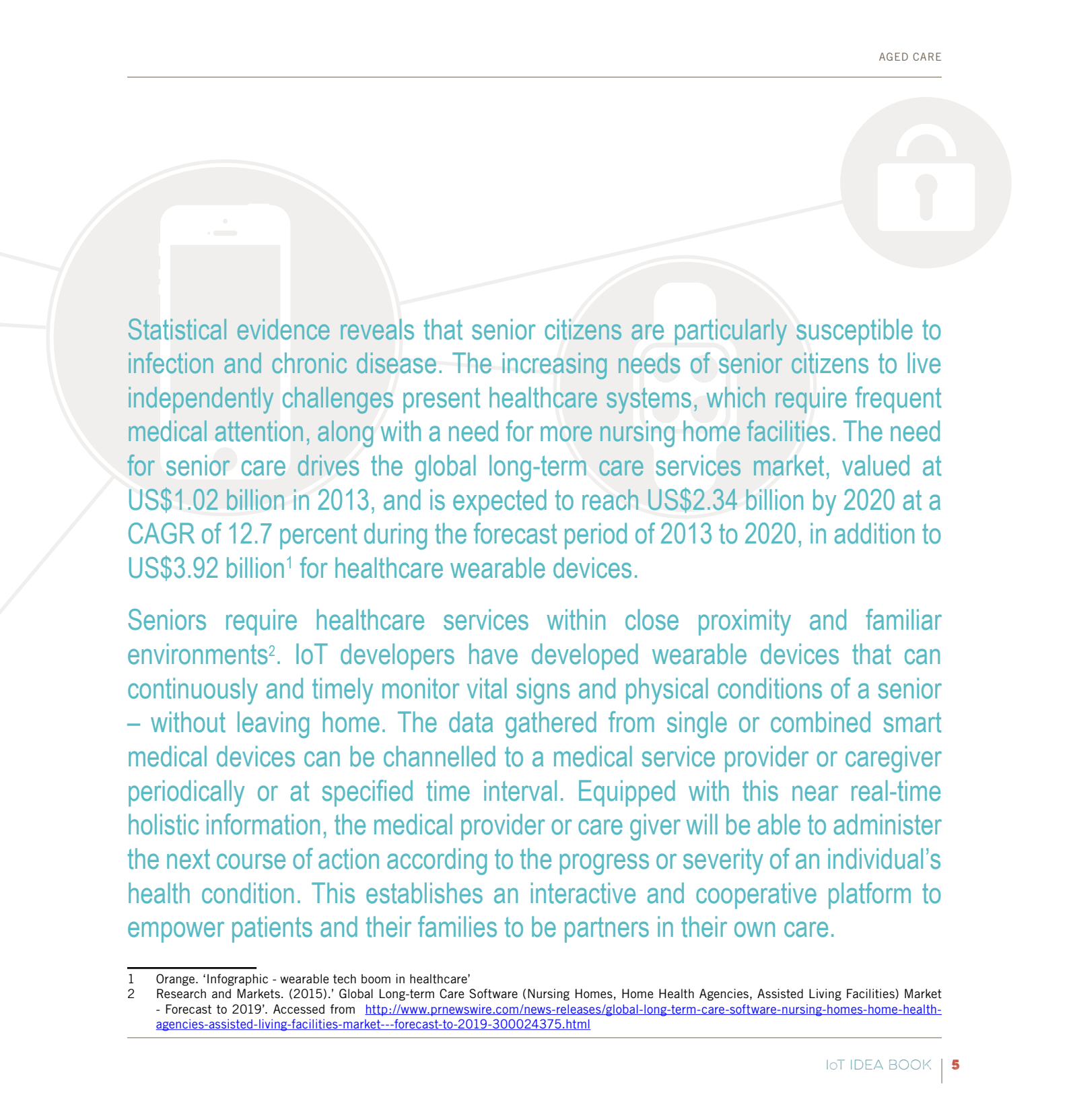
With the escalation in costs and the dynamism of healthcare, continuous profiling and monitoring for high risk patients with chronic health problems through Internet of Things (IoT) makes it possible to enable everyone to overcome health challenges and be able to live independently. The notion of connected healthcare is to enable an integrated end-to-end healthcare delivery system, through interoperable and seamless health information and knowledge, for better healthcare service coordination at the right time and the right place for the right individual, in addition to minimising potential healthcare errors.





## AGED CARE

**WORLDWIDE, DEMOGRAPHICS ARE CHANGING WHERE 16 PERCENT OF THE GLOBAL POPULATION WILL BE AGED 60 AND ABOVE BY 2050. THE LONGER PEOPLE CAN REMAIN MOBILE AND CARE FOR THEMSELVES, THE LOWER ARE THE COSTS FOR LONG-TERM CARE FOR FAMILIES AND SOCIETY-AT-LARGE. WITH PROPER HEALTHCARE PROGRAMMES AND FACILITIES, PEOPLE CAN REMAIN HEALTHY AND INDEPENDENT WELL INTO OLD AGE AND CAN CONTINUE TO CONTRIBUTE TO THEIR COMMUNITIES AND FAMILIES.**



Statistical evidence reveals that senior citizens are particularly susceptible to infection and chronic disease. The increasing needs of senior citizens to live independently challenges present healthcare systems, which require frequent medical attention, along with a need for more nursing home facilities. The need for senior care drives the global long-term care services market, valued at US\$1.02 billion in 2013, and is expected to reach US\$2.34 billion by 2020 at a CAGR of 12.7 percent during the forecast period of 2013 to 2020, in addition to US\$3.92 billion<sup>1</sup> for healthcare wearable devices.

Seniors require healthcare services within close proximity and familiar environments<sup>2</sup>. IoT developers have developed wearable devices that can continuously and timely monitor vital signs and physical conditions of a senior – without leaving home. The data gathered from single or combined smart medical devices can be channelled to a medical service provider or caregiver periodically or at specified time interval. Equipped with this near real-time holistic information, the medical provider or care giver will be able to administer the next course of action according to the progress or severity of an individual's health condition. This establishes an interactive and cooperative platform to empower patients and their families to be partners in their own care.

1 Orange. 'Infographic - wearable tech boom in healthcare'

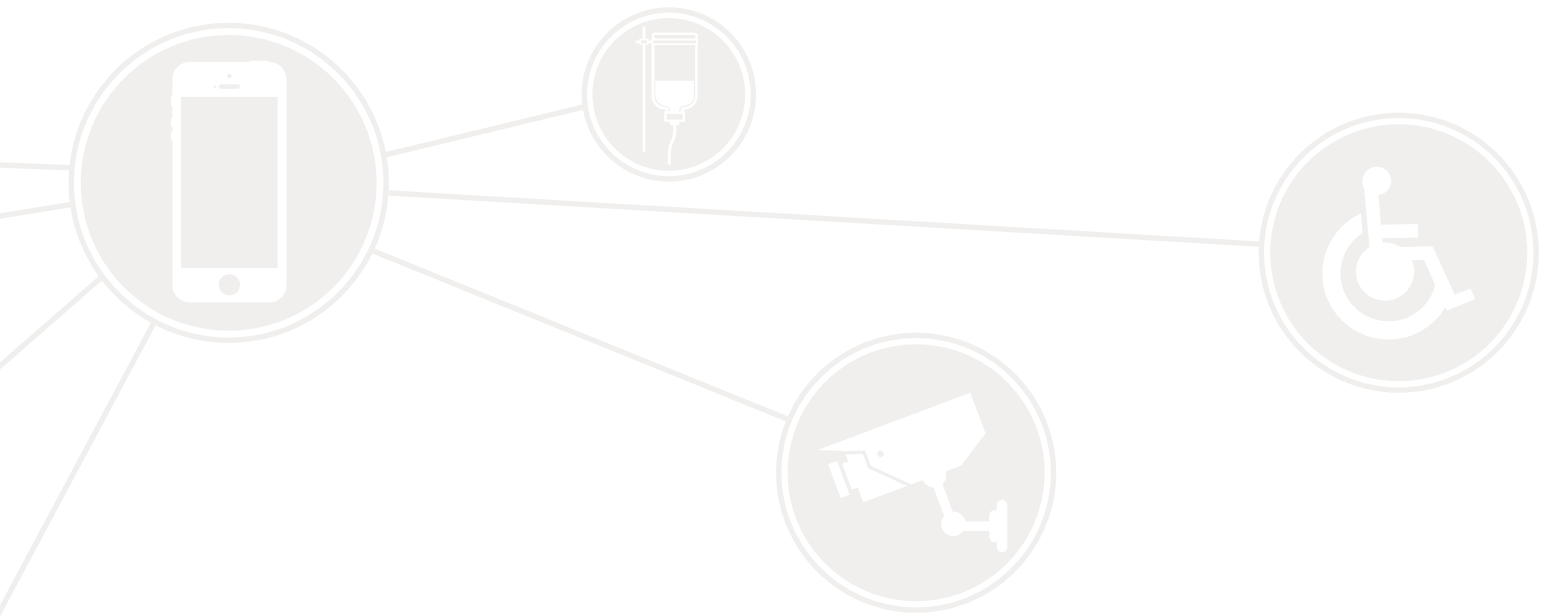
2 Research and Markets. (2015). 'Global Long-term Care Software (Nursing Homes, Home Health Agencies, Assisted Living Facilities) Market - Forecast to 2019'. Accessed from <http://www.prnewswire.com/news-releases/global-long-term-care-software-nursing-homes-home-health-agencies-assisted-living-facilities-market---forecast-to-2019-300024375.html>



# CARE FOR THE 'UNDER-CARED'

WITH THE PROLIFERATION OF WEARABLE DEVICES, OF WHICH 60 PERCENT ARE HEALTHCARE RELATED, THE IDEA OF USING TECHNOLOGY AS MEANS OF MOTIVATING AND TRACKING AN INDIVIDUAL'S ACTIVITY AND WELLNESS STATUS, HAS TAKEN THE WORLD BY STORM. RURAL COMMUNITIES ENCOUNTER DIFFICULTIES IN ACCESSING WELL-ESTABLISHED HEALTHCARE FACILITIES DUE TO GEOGRAPHICAL DISTANCE AND CHALLENGES. OFTEN TIMES, THEY MISS CRUCIAL CONSULTATIONS AND FOLLOW-UPS THAT RESULT IN THE ACCELERATION OF THEIR ILLNESS.



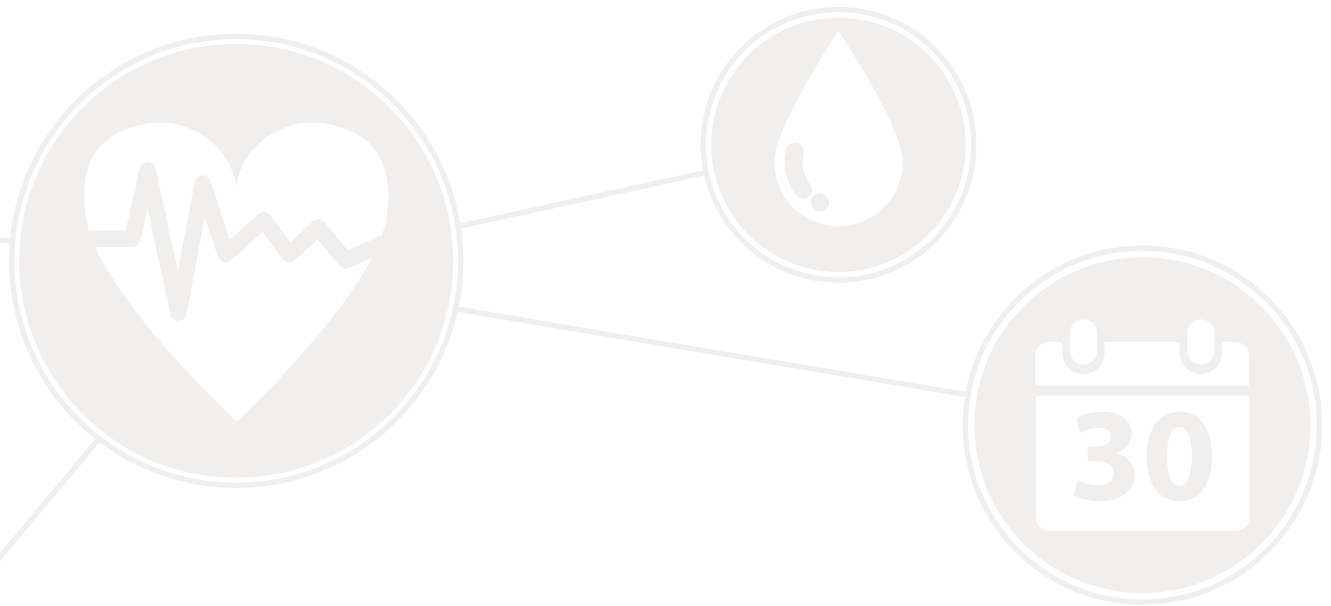


Smart healthcare devices used by communities in rural areas will serve as interaction points; individuals can share their health condition or record from smart devices with medical professionals, who in turn can offer health remedies via remote consultation or virtual coaching. Through readings of vital signs and critical parameters from the devices and teleconference facilities, the medical professional can give expert advice while not being physically present in the same room as the patient resulting in the delivery of timely and accurate treatment regardless of distance or isolation.



# INTELLIGENT MEDICATION ADHERENCE

**MEDICATION ADHERENCE CONTRIBUTES 30-50 PERCENT TO TREATMENT SUCCESS. POOR ADHERENCE TO PRESCRIBED MEDICATION – SUCH AS MISSED DOSAGE, TAKING A WRONG DOSAGE OR STOPPING MEDICATION WITHOUT CONSULTING A DOCTOR – CAN RESULT IN THE REDUCTION OF TREATMENT BENEFITS, INDUCE HOSPITALISATION OR READMISSION, AND OBSCURE THE CLINICIAN’S ASSESSMENT OF THERAPEUTIC EFFECTIVENESS.**



This scenario is prevalent among senior citizens on on-going medication for chronic conditions such as diabetes, heart complications, hypertension and asthma. Medication adherence continues to draw more attention as the cost and use of medication continues to increase, and the advances in medication treatment for various diseases continue.

IoT can address prescription medication non-adherence by dispensing medication into smart bottles or boxes (packages) that track medication adherence and paired with wearable devices to monitor vital signs. The smart packages enables tracking of consumption status; any missed dosage will trigger a voice or text reminder, and any non-adherence will alert the medical provider, caregiver or other family members. This is apart from the wearable devices providing evidence of any adverse

health conditions due to the medication. This information will enable medical professionals to provide countermeasures or interventions to improve medication consumption behaviours. Better information and communication will increase patient engagement and involvement in their own healthcare, their satisfaction with the level of care and loyalty to their health care providers besides reducing medication non-adherence, its associated costs and health risks.

# SMART DRUG DELIVERY

**STUDIES SHOW THAT AN AVERAGE OF FOUR OUT OF 10 PEOPLE DOES NOT ADHERE TO PRESCRIBED MEDICATION. THIS GROUP IS HIGHLY HUMAN AND INSTRUMENT DEPENDENT THROUGH THE USE OF SYRINGES, EXTERNAL PUMPS, PILLS AND OTHER EQUIPMENT, WHICH COULD JEOPARDISE THE TREATMENT REGIME.**

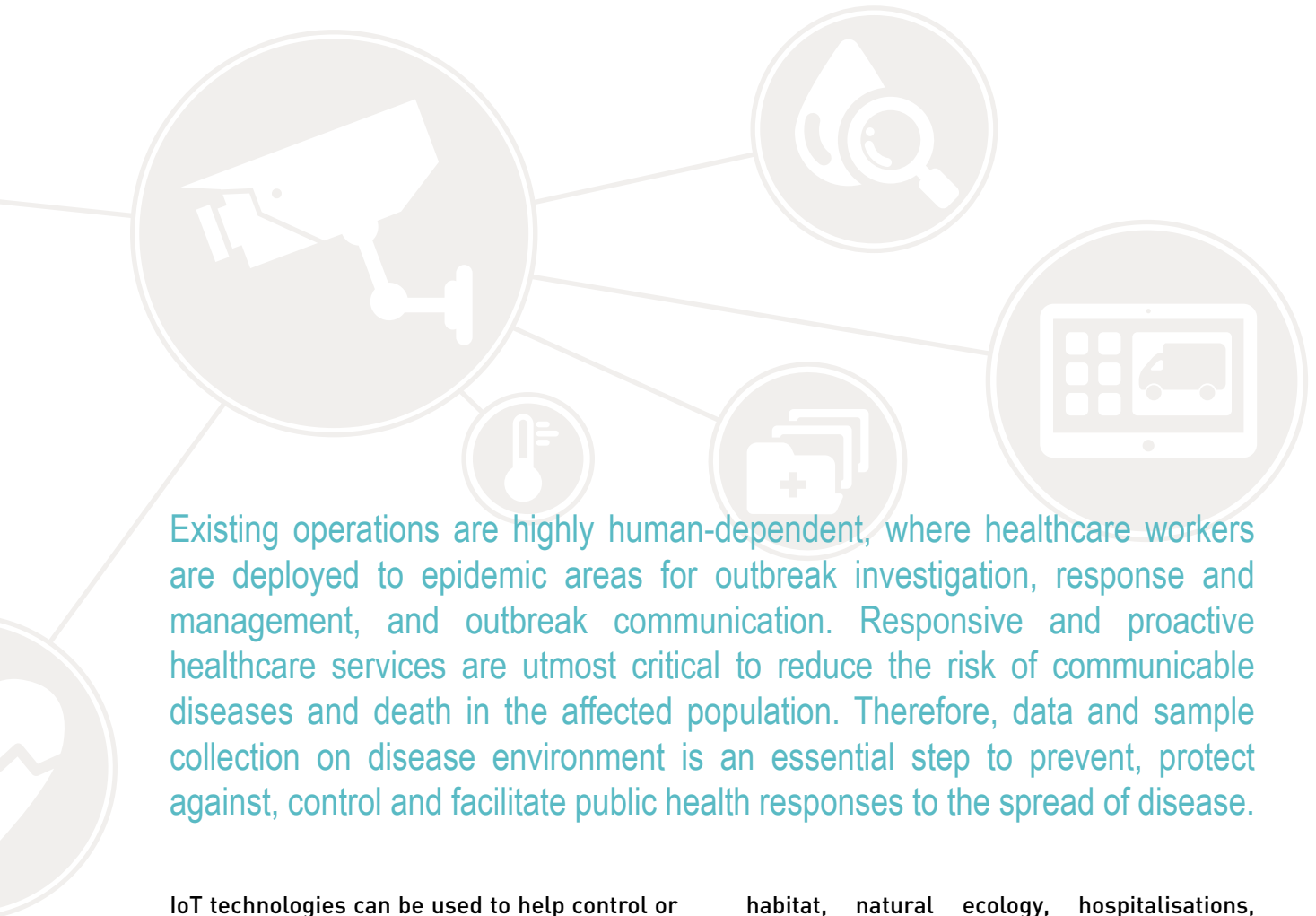


IoT can minimise the non-adherence by providing a smart drug delivery system which comprises a close-loop delivery system. A wearable device can incorporate a biosensor to measure an array of biometrics such as heart rate, hormone levels and temperature. The information captured will be analysed and the wearable device will slowly disperse the medication automatically and painlessly through microneedles. The smart drug delivery system will monitor an individual's body and offer targeted medication with the right dosage at the right time. This will minimise the individual's effort and reduce human error.



# INFECTIOUS DISEASE SURVEILLANCE AND MONITORING

THE GLOBAL SPREAD OF H1N1, SARS AND EBOLA PANDEMIC HAS DEMONSTRATED THE NEED FOR MORE EFFECTIVE DISEASE SURVEILLANCE AND RESPONSE CAPACITIES WHICH IS FURTHER ACCENTUATED BY HIGH MOBILITY AND GLOBALISATION OF TRAVEL AND TRADE.



Existing operations are highly human-dependent, where healthcare workers are deployed to epidemic areas for outbreak investigation, response and management, and outbreak communication. Responsive and proactive healthcare services are utmost critical to reduce the risk of communicable diseases and death in the affected population. Therefore, data and sample collection on disease environment is an essential step to prevent, protect against, control and facilitate public health responses to the spread of disease.

IoT technologies can be used to help control or isolate cases and monitor diseases by identifying and managing contacts appropriately through remote and continuous capturing of information, in order to prevent secondary spread of infections. The deployment of smart devices to monitor the environment and wearable devices to track people movement will facilitate health authorities in their investigation. IoT will provide finer granularity in multi-model data on weather-related occurrences, human

habitat, natural ecology, hospitalisations, immunisations and symptoms, and visibility on a patient's physiology. By having visibility of the source of an outbreak and identified vectors of an epidemic outbreak, countermeasures can be aimed at specific links in the chain of infection, the agent, the source, or the reservoir for effective intervention and containment of disease outbreaks and increase the safety and response of healthcare workers.

# TECHNOLOGIES AT THE HEART OF HEALTHCARE

**ENABLING INTEGRATED HEALTHCARE SERVICES FOR PREVENTION AND WELLNESS MANAGEMENT BY ADAPTING TO THE LIFESTYLE AND NEEDS OF PEOPLE WILL REQUIRE A REDEFINITION OF THE HEALTHCARE DELIVERY SYSTEM. HERE'S HOW MIMOS TECHNOLOGIES ARE REDEFINING THE WAY WE LIVE A HEALTHIER LIFESTYLE.**



## **Home Monitoring System for Aged Care**

Through wearable devices that monitor vital signs that are paired with Mi-SIP, patients in the home can monitor critical health parameters such as blood pressure, heart rate and temperature. This information is then relayed wirelessly through Mi-MESA which provides high speed data transfer to Mi-Cloud which collates all information on a cloud infrastructure then disseminates the information to doctors residing at the clinic or other remote consultation centre. The doctor can then trigger the patient in the same way through their device for immediate action.



## **Connected Rural Healthcare Consultation**

To help connect rural communities with healthcare professionals, Mi-AVComm provides a secured two-way video conferencing capability which paves the way for remote consultation. Paired with Mi-SIP and Mi-Cloud to detect and transmit vital health parameters through the cloud, rural folk needing immediate medical attention can be diagnosed on the spot rather than enduring the long commute to the nearest healthcare facility which can often be thousands of kilometres away.





### Smart Medicinal Packages for Medication Adherence

The packaging of prescription medication can be improved to add 'intelligence' to medication consumption. This is to ensure that patients take medication at the right time. Smart packaging with Mi-SIP can detect the consumption of medicine by the patient, trigger patients to take their dose and alert medical providers if dosages are missed through cloud-based wireless data transmission by Mi-MESA and Mi-Cloud. Herein, through the intelligent reminders and tracking, patients are more involved in their own care and the medical regime can be followed to ensure higher patient-illness success ratio.



### Smart Drug Delivery System for Automated Drug Dispensation

A closed loop delivery system incorporating Mi-Sensor's biosensors measure human biometrics such as heart rate, blood oxygen and temperature. This is then transmitted wirelessly through Mi-SIP which then triggers microneedles embedded in the wearable to ensure automatic medication dispensation with the right dosage at the right time. No longer would patients need to check themselves into the hospital for simple procedures and endure long waiting periods when all these can simply be done in the comfort of their own homes.



### Population and Environment Monitoring of Infectious Diseases

Responsive and protective healthcare services are the answer to address communicable diseases and curb the further spread thereof. Surveillance using Mi-SP displays a heat map of the central and rural population and transmits information fast through a secured wireless infrastructure offered by Mi-MESA and through the cloud by Mi-Cloud. At the data centre, Mi-Semantic performs tabulation and analysis and is visualised using Mi-BIS to give healthcare offices and directorates a clear overall picture of what the situation is, how best to contain it and how to deploy necessary assistance to the affected population.

## MOVING HEALTHCARE INTO THE FAST LANE



A SIP-based multimedia application that supports video imaging, multiple cameras solutions, text input/output and processing of data for multiple sites.

- Seamless video and imaging equipment integration
- Flexible bandwidth for transmission
- Multi-party video conferencing support
- Remote pan-tilt-zoom (PTZ)
- Adaptive streaming
- Region-of-interest (ROI)-based streaming
- Annotation of still images support



A business intelligence platform for customised report creation and business analytics.

- Dashboard management
- Ad hoc reporting
- KPI management
- Location intelligence
- Parallel in-memory database
- Big data processing engine



A cloud infrastructure platform that allows virtualisation of physical hardware.

- Open and neutral architecture
- Comprehensive management modules
- Total service orchestration suite
- Hardware agnostics



A wireless multi-radio mesh broadband infrastructure appliance integrated with multi-protocol broadband connectivity and sensory system.

- IP65 robustness
- Modular design
- Long haul at high throughput
- Integrated sensor appliance
- Wireless infrastructure for surveillance systems



An SOA-based semantic technology platform that supports the development of various kinds of intelligent applications that interface via the W3C web service standard.

- Structured development platform
- Reliable and scalable components
- Adopts open web standards



A solution that comprises a sensor platform and sensor elements to provide real-time feedback of physical parameters.

- Robust and reliable for outdoor usage
- Real-time data measurement
- Wireless communications



A state-of-the art miniature System-on-Chip (SoC) processor with extensive radio features and low power consumption designed for IoT applications.

- Platform for application development
- Small and low profile packaging
- Energy efficient operation
- High transmit power



A versatile video surveillance system with advanced video analytics that automatically detects and alerts occurrences of suspicious activity.

- Event detection video analytics
- Smart client video analytics
- Flexible architecture

**MIMOS is supporting the growth and proliferation of IoT in Malaysia through Big Data IoT Technology Accelerator (BITX) which comprises core technologies that drive the development efforts in IoT in areas of Applications, Smart Devices and Network & Services.**

**To know more about MIMOS technologies go to: <http://www.mimos.my/tech>**



