

TOWARDS THE FUTURE WITH INTERNET OF THINGS



Dr. Hafzal Mohamad, a senior staff researcher (Wireless Innovation) at MIMOS Berhad, speaks about the importance of the Internet of Things and what it will take for Malaysia to get ready for this new technology.



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The Internet of Things (IoT) is a new emerging technology under the 4th Industrial Revolution (4IR). It is the basic concept of connecting any device to the Internet. It enables inter-connection and integration of the physical world and the cyber space. In laymen terms, IoT has the capability to connect physical objects to the Internet remotely.

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Leading the third wave of the IT industry revolution, IoT sets the trend of future networking. According to US-based research/analyst firm Gartner, there will be over 26 billion connected devices by next year or more than thrice the current global human population of some seven point seven billion.

Malaysia has also jumped on the IoT bandwagon. Five years ago in 2014, the Government, through Ministry of Science, Technology and Innovation (MOSTI), produced the National IoT Strategic Roadmap which would serve as the blueprint for creating a national eco-system to enable the proliferation of use and industrialisation of IoT as a new source of economic growth. MIMOS Berhad, the National Applied Research & Development Centre, has also involved in this initiative.

According to Ir. Dr Hafizal Mohamad, a senior staff researcher (Wireless Innovation) at MIMOS, there is a need to review our readiness and progress in IoT. He says: "In order for IoT to succeed, we still need to strengthen the eco-system covering the three crucial elements of deployment of sensors, as well as the expansion of connectivity and development of platforms."

He explains that IoT has three major components. The first are sensors and actuators for detection and collection of data, such as temperature, humidity, light and air

flow. The second is connectivity via communication network such as WiFi, 3G, 4G, cellular and LoRa. Platforms such as Cloud services and the Internet, is the third component that enables application, as well as the use and storage of database, and analytics for the monitoring and control of operations via visualisation dashboard, alerts and notifications and mobile apps.

"For example, room lighting and indoor thermometers can be connected to the Internet to enable remote operation, control and data collection as well as analysis," says Ir. Dr Hafizal, adding that IoT has many benefits, including allowing us to be aware of data and information that may not be visible.

"Take for example, a transport company with a large fleet of buses. Its management can make use of IoT to collect and analyse data about the utilisation of the buses, including whether any of them has to be taken off the road for maintenance."

FOCUS ON NEW TECHNOLOGIES

IoT is important for companies to know certain factors such as how to save on energy cost, how to reduce the cost of running and maintaining buildings, how to increase utilisation of assets, how much revenue can be generated from assets, how best to support environmental sustainability objectives, how to deploy assets which require a repair process and many other concerns.

"Currently the focus at MIMOS is on new technologies under 4IR, with several technology pillars, one of which is IoT. It is an important R&D focus because we want to create new technology and solution for the benefit of the country and the people," says Ir. Dr Hafizal.

An agency under the Ministry of International Trade & Industry (MITI), MIMOS undertakes research and development specifically in the sectors of Information & Communication Technology (ICT) and Electrical & Electronics (E&E).

"Our main stakeholders are MITI and the Ministry of Finance who want



Various IoT devices used for R&D work are displayed at the MIMOS IoT laboratory showcase.

to see tangible results which can be applied," says Ir. Dr Hafizal, adding that the results can be used for several industries, such as agriculture and to assist in the development of small and medium-sized enterprises (SMEs).

IoT technology is used primarily to increase productivity and to reduce the cost of operations for industrial application. It can also be applied to drive engagement and customer experiences, create new products and business models and advance environmental initiatives. However, MITI's current IoT emphasis is on improving the operational efficiency of SMEs and, at the same time, focusing on IoT related to the manufacturing and services sectors which are the highest contributors to our economy. According to the Department of Statistics, Malaysia's gross domestic product (GDP) in 2018 stood at RM1.36 trillion, of which 62.4% and 20.1% were contributed by the services sector and the manufacturing sector, respectively.

HOW MIMOS CAN HELP

Ir. Dr Hafizal says most local companies in Malaysia do not have the capability to conduct their own R&D. "This is where MIMOS comes in to help. First, we carry out work under the MITI programme where the Ministry assists companies which require development and deployment of R&D work to meet national objectives of improving performance and

enhancing the competitiveness of industries. We begin projects by having proof of concepts whereby the companies state their problems and then we discuss solutions. From there, we will embark on full-blown projects” he says.

In addition, MIMOS makes technology previews and presentations to the various ministries, government departments and agencies. MIMOS also collaborates on projects with specific requirements or problems that these organisations want to address.

POTENTIAL & CHALLENGES

The key infrastructural component for IoT to work is Internet connection. While Malaysia already has good “human-to-human” Internet network provided by the various telecommunication companies, Ir. Dr Hafizal feels that better convergence of networks is required to connect things, particularly in remote and less populated areas which are not covered by cellular networks. He says the requirement to connect things are different from those for connecting humans, such as the data connection rate.

“The data transmission rate is lower for IoT which makes it doable to connect a huge number of things. The potential to connect things is tremendous and I believe local telcos are aware of and prepared for this,” he says.

Expanding further, Ir. Dr Hafizal identifies agriculture as a potentially huge area for greater deployment of IoT and says that this goes in tandem with Malaysia’s aim to further modernise agriculture.

“The application of IoT can expedite the modernisation of agriculture. But there are challenges such as the cost of deploying sensors in the fields. This is not low enough to make it cost-efficient. Big conglomerates like Felda may be able to bear the high cost of deploying sensors but it is tough for small players,” he says.

Another issue is the longer time for the agriculture sector to see returns

on investments in IoT as opposed to faster gains in the manufacturing sector. Manufacturers are already using IoT to improve productivity and lower operational costs though they may not publicise it. Through smart manufacturing with the use of IoT, they have benefitted from cost reduction and greater operational efficiency.

Another large area for IoT applications is the Smart Home for consumer market. IoT addresses modern needs such as for home camera surveillance, alert system, energy management, temperature control, health and wellness, elderly care, home maintenance and smart entertainment. Already well established are remotely operated smart TVs and speakers, robotic vacuum cleaners and other E&E equipment and gadgets, many with the use of AI and commands using voice recognition. However, MIMOS does not focus on the consumer market. Instead its emphasis is on industrial and enterprise applications of IoT.

ENGINEERING SECTOR

IoT is also widely used in the engineering sector, with cross-disciplinary applications, such as between mechanical and electronics and other engineering fields. It is particularly useful in areas which require predictive maintenance that can facilitate proactive maintenance. Predictive maintenance is more operationally efficient than reactive maintenance.

“Predictive maintenance can be ascertained through the collection of data that show the use and behaviours of things. For example, if a piece of equipment vibrates at certain level or after a period of use, it is time for to do maintenance rather than wait to do repairs only when it breaks down (reactive maintenance),” says Ir. Dr Hafizal.

In engineering, there are already IoT applications, such as those involving utility companies, such as Tenaga Nasional, which applies smart

grid for power distribution network, as well as water distribution companies or agencies that use IoT to obtain water flow and pressure data or to detect leakage for early mitigation.

Another area in which IoT is essential is smart building management, such as those involving hospitals, airports and shopping malls where power consumption is huge. IoT can be applied to help reduce the cost of power usage in such buildings.

“These are but just a few examples of IoT applications. In future, more things will be connected and there will be an increasing trend for IoT deployment in the country. People want more connectivity. Improving the quality of life is a major consideration for the consumer market while for business markets and enterprises, it is how to increase efficiency and productivity as well as to lower costs. Businesses will be more competitive than ever in future, so even a small reduction in costs will be of benefit,” says Ir. Dr Hafizal.

IMPLEMENTATION OF 5G

Ir. Dr Hafizal is a member of the Malaysian Communications & Multimedia Commission (MCMC) task force committee for 5G implementation in the country. He says 5G can help provide connectivity to IoT sensors and that Malaysia has taken steps towards implementation.

According to him, 5G has three focus areas. The first is the Enhanced Mobile Broadband which can send data at a rate of 10 times higher

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than the current 4G rate. The second focus is Ultra Reliable Low Latency Communications, such as for remote surgery which cannot afford any delay in transmission. The network for such a requirement involves transmission in milliseconds. The third area is Massive Machine Type Communication (MMTC) which allows telcos to embark on providing connectivity to support various IoT applications.

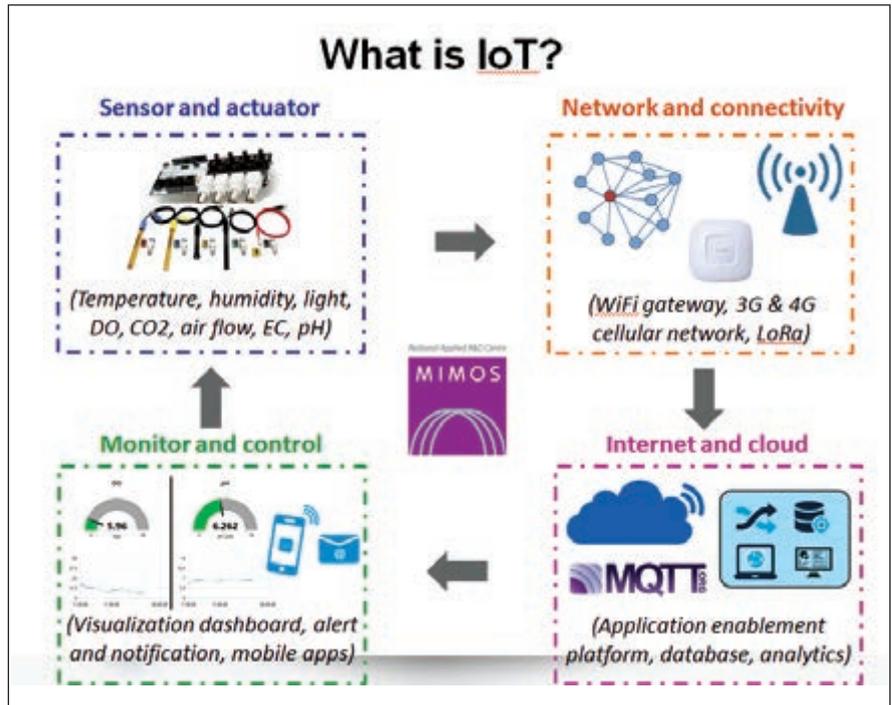
"Telcos must cater for future MMTC to avoid network congestion. This is not only for connecting humans but also things and services," says Ir. Dr Hafizal, adding that it is good for the whole country to embark on 5G to enable more applications and deployment of IoT for huge economic benefits.

"On a scale of 1 to 5 (five being the full IoT deployment), I would say Malaysia is at stage 2 or 3. The use of IoT is not as widespread here as in China, Japan and South Korea where applications, especially in the development of smart cities and modernisation of network connectivity, are already advanced."

In terms of developing connectivity, Malaysia had already taken the right direction in embarking on 4G. We are now moving towards 5G, while in platform development, more needs to be done although there are already companies which focus on this area. Other issues to be addressed are the lack of the economies of scale to produce the country's own sensors and time-consuming factor in sensor hardware development work.

BIG CHALLENGES

Ir. Dr Hafizal says the biggest challenges in the development of IoT are the aspects of technical, social, business and security. Technical challenges encompass IoT devices. Key considerations are how to make devices at low cost, how to make them robust (so that when they are deployed, they can be used for a long time), how to make them connected anywhere, anytime and how to link the platform to the intelligence network, such as algorithm for data analysis



and implementations based on data collected.

In terms of security, user concerns about security must be addressed while, from the technical aspect, end-to-end security must be in place. Data sent via network from the sensors must be encrypted before reaching storage platforms such as Cloud services, which complete the IoT end-to-end eco-system. Data stored in Cloud can be retrieved at any time and from anywhere for the purpose of implementing data intelligence and analytics in order to assess operational efficiency and plan mitigation measures.

IoT applications are supported by Artificial Intelligence (AI) and Augmented Reality (AR) technology. AI helps in understanding more about data and deriving meaningful conclusions which are useful for implementation, while AR provides more dimensions for the collected data which involve complex operations.

"In Malaysia, we will see more connected machines in factories and inside buildings such as hospitals and airports, in the immediate future. Indoor connections are already

happening in the first IoT wave," says Ir. Dr Hafizal who predicts that the second wave will be in the utilities sector. As there will be a higher demand for electricity and water, IoT will enable the country to meet this demand efficiently. The third wave will occur outdoors, especially in the agriculture sector, in efforts to achieve widespread mechanisation.

As for the consumers market, he says the future will certainly see more and more things connected to the Internet, from TVs, mobile phones, vacuum cleaners and air-conditioners to washing machines and remote water meter readers.

Reading of meters for water usage in homes will no longer be done manually in future as remote reading will be possible with the use of IoT technology, such as LORA (long range low power wireless communications technology), Sigfox (wireless networks to connect low-power objects over long range with low data rate) and NB-IOT (NarrowBand-Internet of Things), which includes 5G for massive connectivity.

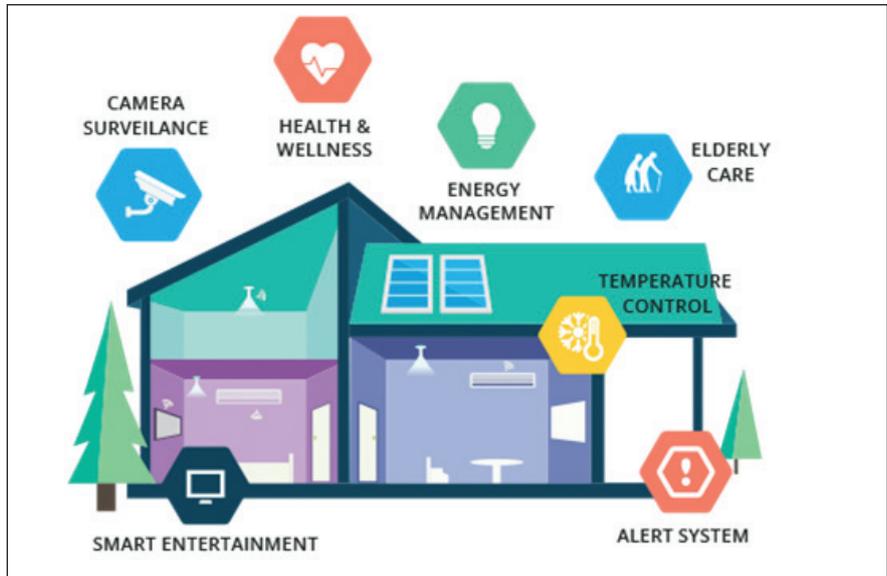
CAPACITY BUILDING

Since IoT is an emerging technology,

COVER STORY



Ir. Dr. Hafizal Mohamad (right) with Ir. Tan Seng Khoon, committee member of IEM Information & Communications Technology Special Interest Group, in the IoT laboratory showcase at MIMOS office Technology Park Malaysia.



Smart Home

graduates in engineering and information technology (IT) are the ones who can fill positions in this area. However, Ir. Dr. Hafizal says they will need to get updated on the new technology as things are happening very fast. "Though we have a good supply of engineers and IT personnel currently, there is a major concern for the long term as there is a decrease in the number of students taking Science, Technology, Engineering & Mathematics (STEM) subjects in schools and universities."

From tertiary education level to the stage of supply to the industry, university students and graduates can still learn new knowledge and acquire IoT skills. He says the entire education process must be updated to meet new as well as future requirements and for the divergence of knowledge and skills.

While it is critical for Malaysia to set in place the crucial IoT elements of sensors and actuators, network, connectivity and application enablement platforms to make IoT deployment successful, it is also equally important to develop people with the knowledge and skills to drive it. It is the people who can identify the processes to define and improve

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success metrics and to establish embedded sensors in order to capture information as well as to install IoT devices and ensure that these are appropriately linked to analytics tools.

It is also the people who can conduct analysis to uncover performances and trends as well as recommend actions to optimise performance. After all, what really matters is not the mere action of collecting or analysing data, but what to do with it. This is where capacity planning initiatives come in and it is especially crucial for Malaysia, more so if we want to gain a lot more from the socio-economic perspective. The emergence of IoT is spawning new forms of businesses which can help our economy to become robust,

while the deployment of IoT will not only gain traction in industries such as engineering, transportation and logistics but also in consumer sectors such as home automation and connected homes which can further enhance the people's lifestyle and to be in tune with the progress in more advanced nations. ■

Ir. Dr. Hafizal Mohamad, received the B.Eng. with First Class Honours and Ph.D. in Electronic Engineering from University of Southampton, UK in 1998 and 2003, respectively. He was a faculty member at the Multimedia University, Malaysia from 1998. Since 2007, he is a senior staff researcher at MIMOS Berhad, working on IoT, sensors and cognitive radio network. He received the ASEAN Outstanding Scientist & Technologist Award in 2017. He has published over 100 articles in high impact journals and conference proceedings. He has 7 patents granted and 41 patents filed.