THE SCIENCE WORLD
A Monthly e Magazine

Popular Article

ISSN:2583-2212
November, 2022; 2(11), 1927-1931

Internet of things (IoT) and Its Applications

Akash Golaviya[1]*, Madhuri Patel[2], Mayur Jhala[3]

[1]College of Veterinary Science, Anand, Kamdhenu University, Gandhinagar-382010, Gujarat, India
[2]Indian Veterinary Research Institute (IVRI), Izzatnagar-243122, Uttarpradesh (UP), India
3Directorate of Research and Dean PG Studies, Anand Agricultural University, Anand-388001, Gujarat, India
https://doi.org/10.5281/zenodo.7373629

Abstract

The technological developments in this 21st century has a potential to influence our daily lives. Internet of things (IoT) is a network formed by interconnecting heterogeneous things or objects aimed to solve an addressed problem that generally requires interdisciplinary approaches. IoT provides each physical object/device with the opportunity to see, hear and talk with others so that they can share their knowledge and make decisions. The independence of humans to interact, contribute and collaborate on things have expanded with an increase in the use of mobile technology and smart devices from Healthcare/Medical (IoMT), Animal Health (IoAHT), Agriculture (IoAT), Diagnostic (IoDT). Future studies will need to seek ways to successfully empower the utility of IoT enabled technology in health of animal and human.

Introduction

The IoT is the giant network of connecting "**THINGS**" be it devices like cell phones, bands/any wearable devices, in health monitoring systems, diagnosis, agriculture, security alert system, wireless sensors or R&D instruments (Basatneh *et al.*, 2018). Recent advancement of technologies, easier availability of internet and big data era and their prospects in applied areas such as biotechnology and biomedical are tremendous. Advanced smart sensors, smart phones-based instruments/devices and integrated networking provides automation in research and development (R&D) with IoT (Putri *et al.*, 2018). Key benefits by using IoT in healthcare are increase in patient engagement, early diagnosis, better patient outcomes, reduced manual errors, efficient handling of resources and ease of providing services. The use of biosensors and wearable technologies is also becoming increasingly important for animal health management. In animal it helps in detection of sweat constituents, measure body temperature, observe behavior and movement, oestrus detection, mastitis detection, analyse sound, prevent disease, and detect

presence of viruses and pathogens (Neethirajan, 2017).

Applications of IOT

1. IoT Impact on Healthcare (IoMT)

Healthcare is given the extreme importance now a- days by each country with the advent of the novel corona virus. In such areas where the epidemic is spread, it is always a better idea to monitor these patients using remote health monitoring technology. So, Internet of Things (IoT) based health monitoring system is the current solution for it. By 2022, the estimated number of RFID tags sold is expected to reach 209 billion, from a mere 12 million in 2011. Due to advancement in technology, healthcare services are shifting from hospital-centric care to personalized individual-centric services. IoMT helps in connection of sensor to healthcare devices that help in remote patient monitoring, remote temperature monitoring for vaccine, blood coagulations testing, air quality sensor, glucose monitor, connected cancer treatment, heart rate, ECG monitoring, IoT connected contact lenses, depression and anxiety monitoring, wound monitoring through IoT arrangement.

2. IoT in Diagnosis

The most effective way of diagnosis Covid-19 is through the RT-PCR test but as the number of cases and potential patients in the world is rapidly growing, the number of test kits is not enough to cater to the demands. IoT helps in development of image, voice and sound based diagnostic aids.

2.1 Image-based diagnosis

Ardakani *et al.* (2020) have done a comprehensive study where they compare various popular open source CNNs like GoogleNet, AlexNet for the diagnosis of COVID-19 using computed tomography (CT) images of lungs of patients. Other researchers also proposed a machine learning method that is capable of diagnosing COVID-19 based on x-ray images of the lungs of potential patients.

2.2 Voice-based diagnosis

Several voice-based COVID-19 diagnostic tools have been created in the past few months using cutting edge machine learning and deep learning technologies. Imran *et al.* (2020) proposed a computational system named AI4COVID-19 that can diagnose an individual with COVID-19 based on the sound of the individual's cough as shown in fig. 2. It is capable of distinguishing between COVID-19 cough and several other types of coughs, even normal disease-free cough.

2.3 Breath based diagnosis

The composition and pattern of volatile organic compounds (VOCs) in the exhaled breath can provide deep insight about infectious agent, inflammation, blood glucose level and various disease includes many

Popular Article
Published: 28.11.2022

cardiovascular (CVDs) and chronic respiratory diseases in animal and human (Friedrich, 2009). Several invasive fungi (IF) metabolites are VOCs that can be detected in the breath of patients with pulmonary IF infection

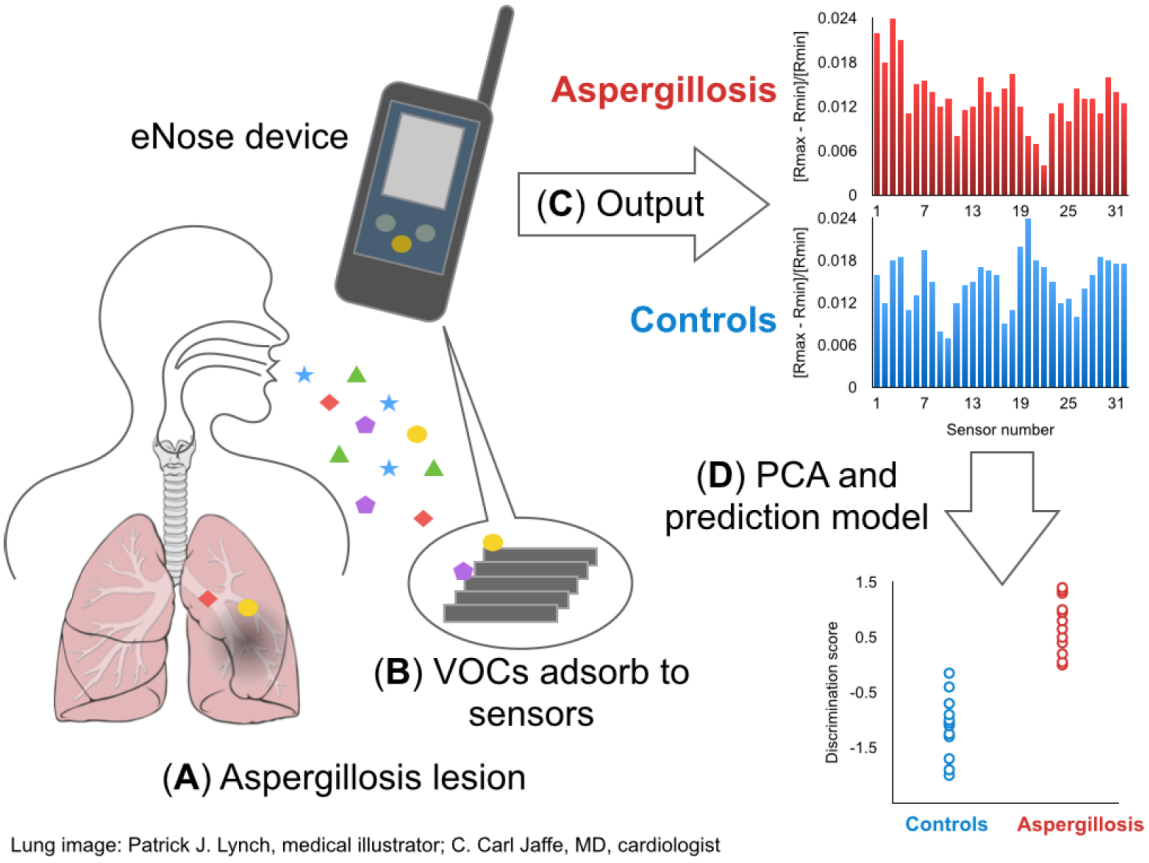

Figure 1. Graphic representation of the eNose operation for Aspergillosis diagnosis. (Source: Savelieff *et al*., 2018)

3 IoT in Animal Health (IoAHT):

One of the early applications for sensor technology at an individual animal level was the accurate identification of cattle entering into heat (oestrus) to increase the rate of successful pregnancies and thus optimise milk yield per animal. This was achieved through the use of activity monitoring collars and leg tags. Additional information relating to the behaviour of the cattle, namely the time spent eating and ruminating (Figure 2), health of domestic animal (temperature, sweat and saliva analyzers), detecting subclinical ketosis and mastitis using microfluidic biosensors, stress detection sensor, sound analyzers sensor (heifer pneumonia, respiratory infection) further insights of economic value into the wellbeing of the animal (Neethirajan, 2017).

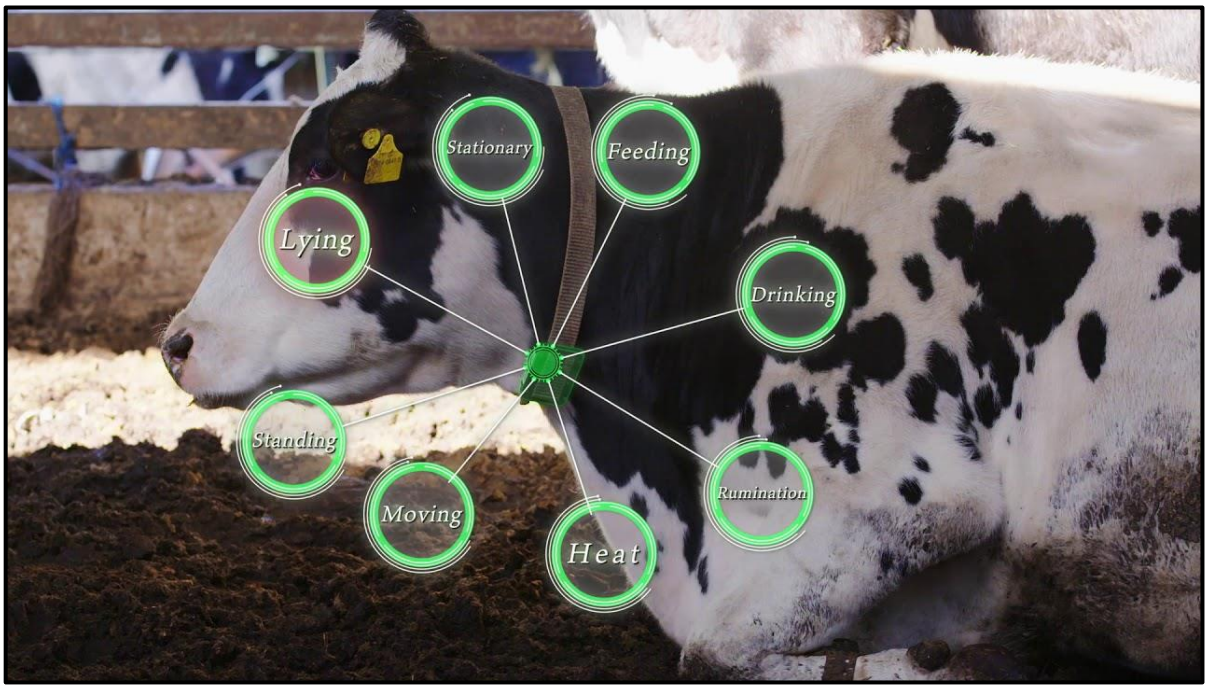

Figure 2. IoT Analysis of cattle activity "U-motion(R)" (Source: NTT Technocross)

4. Smart Laboratory

Only once biotech research is truly reproducible can we quickly commercialize new inventions and pinpoint errors in the R&D process. The biotech facilities of the future will rely increasingly on automation. Ginkgo bioworks is one of the biggest examples of IOT in biotechnology. This organism company launched Bioworks1- it conducts research with 20 robots, in nearly 18000 sq. ft. Everything in this facility is bar-coded and logged into a virtual database. Bar codes facilitate easy conduction of an experiment, and it even keeps tabs on inventory to place automated orders for diminishing resources.

Conclusion

In conclusion, IoT technology is a new, diverse, and uncertain field that is open for exploration. Future studies will need to seek ways to successfully empower the utility of IoT enabled technology in health of animal and human. With modifications and testing in animal models, these innovative technologies are now being considered for their future use in health, livestock development and welfare.

References

Putri, A. O., Ali, M. A., Saad, M., & Hidayat, S. S. (2018). Wearable sensor and internet of things technology for better medical science: A review. *International Journal of Engineering & Technology*, *7*(4.11), 1-4.

Popular Article
Published: 28.11.2022

Neethirajan, S. (2017). Recent advances in wearable sensors for animal health management. *Sensing and Bio-Sensing Research, 12*, 15-29.

Ardakani, A. A., Kanafi, A. R., Acharya, U. R., Khadem, N., & Mohammadi, A. (2020). Application of deep learning technique to manage COVID-19 in routine clinical practice using CT images: Results of 10 convolutional neural networks. *Computers in biology and medicine, 121*, 103795.

Imran, A., Posokhova, I., Qureshi, H. N., Masood, U., Riaz, M. S., Ali, K., . . . Nabeel, M. (2020). AI4COVID-19: AI enabled preliminary diagnosis for COVID-19 from cough samples via an app. *Informatics in Medicine Unlocked, 20*, 100378.

Savelieff, M. G., Pappalardo, L., & Azmanis, P. (2018). The current status of avian aspergillosis diagnoses: veterinary practice to novel research avenues. Veterinary clinical pathology, 47(3), 342-362.