

Introduction



The Future Of Veterinary Care Is Digital Health For Pets, every minute of every day, technology exceeds people's expectations. It didn't take long for veterinarians and pet owners to acknowledge the benefits of technology when creative brains were at work. Pet adoption has increased dramatically in big cities and even rural places around the world in the last year. Many individuals consider their pets to be children or loyal companions, and they are also a big global enterprise. The pet market has expanded, with sales of pet foods, toys, pharmaceuticals, and wearables increasing dramatically. According to Mordor Intelligence, the worldwide pet service market was valued at USD 20,727.0 million in 2020, and it is expected to grow at a compound annual growth(CAGR) of 5.4 % to USD 28,561.9 million by 2026.

1.Digital technologies for pet care

As the healthcare business transitions into the digital age, it's only natural that the pet health industry would follow suit. Due to sophisticated health monitoring platforms and wearable gadgets, pet owners may now follow virtually every aspect of their pet's health. The hidden becomes apparent with smart pet technology, allowing us to provide better care for our pets. By leveraging technology to learn about dogs, we can notice health changes, track their health over time, and see the effects of diet, which can help us better understand the relationship between nutrition and health.

1.1 Remote Monitoring

- **Link**

Link is a smart pet wearable that allows you to track your pet's location and activity in real time. Smart Tracking Technologies, a technology firm based in Jacksonville, FL, created it. Link connects to a smartphone through Bluetooth LE, allowing owners and pet care facilities to identify and track a pet's location and movement using a smartphone app. When the pet is sleeping, Link goes into a battery-saving 'sleep' mode and wakes up when the animal moves. The main CPU is triggered to activate the monitoring device by a motion detection wakeup feature. The nRF9160 system-in-package from Nordic Semiconductor is used to provide LTE-M connection (SIP). The technology ensures the remote tracking is always available when there is cellular connectivity, regardless of smartphone range.

- **Vet Gaurdian**

VetGuardian is the first and only zero-touch remote telemonitor designed specifically for veterinarians. The device continuously collects vitals from animal patients such as pulse, temperature, and respiration rate from up to five feet

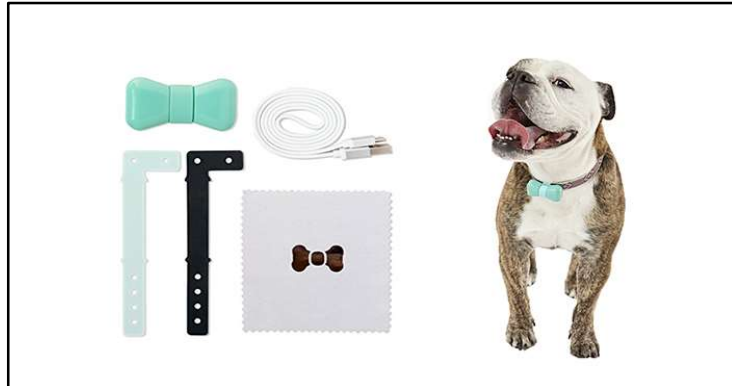


away without the use of wires or direct contact, reducing stress for both animals and vets. VetGuardian is an excellent tool for monitoring post-surgical, overnight, and ICU animal patients. Even when they're not in the clinic, veterinarians have an extra set of eyes on their patients with VetGuardian.

1.2 Wearables

- **Whistle**

Whistle is a GPS enabled pet tracker that clips into your dog's existing collar. The device tracks your pet's whereabouts



using AT&T's cellular connectivity, as well as GPS and GLONASS signals. As a result, this GPS dog tracker may be best suited for medium-to-large dogs rather than little pets. Instead of utilising a one-size-fits-all GPS dog collar or an enormous pet tracking collar for dogs, the handy connection piece keeps the Whistle securely linked to your dog's existing collar. Whistle is more than simply a pet GPS tracker; it also keeps track of activity. It examines calories burned as well as time spent resting or being active. This function provides insight into your dog's everyday activities and can assist you in addressing health or mental stimulation issues.

- **Petkit**

Petkit has a lot of features that make it a good choice. Not only will it track your dog's activities, but it will also provide health analyses,



consumption, health alerts, and mood information. The health analysis is ideal for senior pets and can be shown to your veterinarian during visits. The user's phone will receive automatic updates regarding their dog. It allows users reminders, among other things, directly on their smart phone device.

2. Pet Prosthetics Get Boosted by using 3-D printing

In the future, 3D printing offers tremendous promise for assisting pets. The capacity to create a completely bespoke prosthetic at a low cost is critical, and as technology advances and expands into other materials, more dogs (and their owners) will be able to benefit. It's possible that seeing a dog



with one or two prosthetic legs may become as frequent as seeing humans with prosthetic limbs. Some of the fantastic applications are: Veterinarians in Brazil recently utilised a 3D printer to create a new shell for Fred, a tortoise whose old shell was severely destroyed in a forest fire. Beauty the bald eagle was shot in Alaska, and the conservation group Birds of Prey Northwest enlisted the expertise of a mechanical engineer to 3D print a new beak for her. Biologists have also used the technology to print bat models to learn about their flight behaviour without having to experiment on the creatures themselves, and to create small harnesses to keep spiders immobile while studying their brains.

3. Technology Advancing Veterinary Medicine

The science of veterinary medicine has advanced by leaps and bounds, allowing veterinarians to make speedier diagnoses, more precise prognoses, and, ultimately, save animal lives. Technology has also resulted in greater care — not only for the dogs, but also for their owners. Some of the examples are:

- **Microchipping**

For a modest cost, many vets and animal shelters now microchip animals. Families that finish this procedure and register their pet with a microchip firm are provided with a dependable form of pet identification in the event that the animal wanders away. The microchips, which are approximately the size of a grain of rice and are normally implanted just beneath the skin between the animal's

shoulder blades, contain a registration number and the phone number for the registry for that specific brand of chip. Handheld scanners can read the chip's radio frequency and display it on the screen. If your pet goes missing, a veterinarian or an animal shelter can locate it, use a scanner to determine the animal's registry, and then contact the registry for information on how to return the animal.

- **Ultrasounds**

One of the primary drawbacks of using an MRI on an animal is that the technique necessitates the subject remaining totally still throughout the procedure. Unlike humans, who can be commanded not to move an inch, pets must be sedated to achieve the same results. Because anaesthesia is so expensive, using an MRI equipment in a veterinary office is typically impractical. However, ultrasound technology may be used on an awake animal, saving a lot of money on anaesthetic. Cardiovascular doctors are now using the same technology that is often used on humans to create photos of fetuses as they develop to create 3D and even 4D images of hearts.

- **Recombinant DNA**

The discovery of recombinant DNA, or rDNA, has set the stage for a medical revolution, including and particularly in veterinary medicine. Drugs like insulin, somatotropin, and prolactin were difficult to manufacture before the discovery of rDNA. We can not only make medications cheaper to make with rDNA, but it also opens the door to gene therapy. Veterinarians can use rDNA methods to restore missing or damaged genes in animals and treat a variety of medical problems. Because there is still a dispute in the business about how ethical it is to replace animal genomes, the technology has not yet reached its full potential.

- **Microfracture Detection**

The health of thoroughbred racehorses is jeopardised by bone failure. Horses may acquire small bone cracks as they train. These can develop into fractures if not identified. Researchers have devised a means of detecting the sonic waves produced by micro-fissures in the hopes of preventing this problem.

4. Alternatives to Animal testing

The invention and execution of test procedures that do not require the use of live animals are alternatives to animal testing. Replacing animals used in testing will increase the quality of our science as well as its humanity. Fortunately, the development of non-animal technologies is accelerating. Animal tests are being phased out in areas including toxicity testing, neuroscience, and medication development due to scientific advancements. However, there is much more to be done. Some of the examples:

- **Artificial Intelligence**

We can interpret millions of pages of scientific literature using computers with learning capabilities to assist pharmaceutical corporations in developing new medications. The computers are capable of discovering previously unknown relationships between diseases, as well as learning and making recommendations depending on fresh data. It will, in fact, lower research expenses and change the landscape of animal testing in the long run.

- **3D Bioprinting Technology**

We can finally produce artificial skin with 3D bioprinting technology, which is likely to provide a viable alternative to some types of animal research. Prior to commercialization, we can test pharmaceutical skin goods on real human skin. As a result, we can comprehend the impacts of these ointments on human skin. Even though it would be costly, establishing effective technologies will necessitate animal research streamlining and modernization.

- **Mitra® Microsampling and VAMS™ Technology**

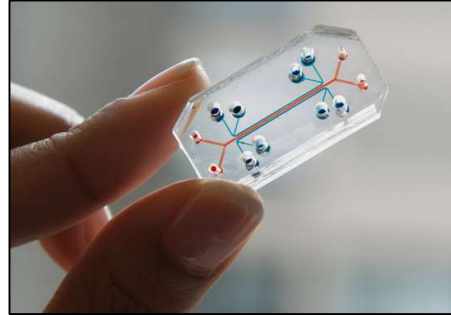
Preclinical researchers can employ Mitra microsampling technology to reduce the volume of blood collected from laboratory animals like rats and mice, reducing the number of animals used in studies. VAMS (volumetric absorptive microsampling technology) extracts a little amount of blood from the animal in a controlled manner. It enables for several samplings of a single animal at different times, reduces reliance on satellite populations, and removes the costs of cold chain transit and storage. Indeed, microsampling is a fantastic example of how, right now, in our labs, a revolution in animal research is taking place.

- **Microchip organs**

These microchip organs could potentially replace animal experiments by providing a more ethical disease model that can provide a deeper level of insight into a medication candidate's efficacy and toxicities. Some of the examples are:

- **Lung-on-a chip**

By simulating the complex mechanical and biochemical properties of a human lung, the lung-on-a-chip provides a new in vitro approach to drug screening. It's a little memory-stick-sized gadget made of a clear, flexible polymer with hollow channels produced using computer microchip manufacturing techniques.



- **Human-on-a-chip(ichip)**

Lawrence Livermore National Laboratory scientists and engineers are working on a "person-on-a-chip," a microscopic external recreation of the human body that combines biology and engineering.



Microfluidics (networks of microscopic tubes and channels) and multi-electrode arrays are being used by the team (devices that connect neurons to electronic circuitry). The iCHIP (in-vitro Chip-based Human Investigational Platform) initiative replicates four important biological systems: the central nervous system (brain), peripheral nervous system (nervous system), blood-brain barrier (brain barrier), and heart. It's a system designed to more precisely resemble the human environment so that scientists may avoid the time-consuming process of animal testing, which doesn't always provide us with information that is important to humans.

