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# Inside the Internet of Things

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When Brittany Bull graduated from Pelican Park High School in Cape Town, South Africa in 2017, she was destined to become an explorer. Today, the 18-year-old is an intern at XinaBox Limited, a high-tech company in South Africa that actually purchased the first privately owned satellite in Africa with the goal of helping high school students learn how to build satellites.

Bull is part of a team at XinaBox that is building one of South Africa's first privately owned nanosatellites (think small) to launch into space. The nanosatellites that Bull is working on will be released by a rocket at an altitude of approximately 250km, and will travel to the International Space Station (ISS). "That's extreme low earth orbit. That's the first time a satellite is going to fly in that orbit and it's the first time a satellite that small is going to fly," Bull recently told *Forbes Africa*.

Bull's work gives new meaning to the notion of a truly hands-on internship. She is not only using her engineering and coding skills, but also immersing herself in what has come to be known as the Internet of Things, the industry in which XinaBox operates. XinaBox creates specialized sensors that give real-time readings on things like temperature and humidity levels. Those sensors are then built into XinaBox's satellite, loaded on a rocket and launched into Earth's orbit. The interns and high school students working with XinaBox get to study and play with the data transmitted from those sensors – straight from outer space.

"Programming, programming, programming! Without that specific skill, everything else is secondary." — Bjarke Gotfredsen

The Internet of Things or IoT business is topping many lists of technology-driven industries to watch as the calendar turns to 2019. If you're like most of us, you're wondering what IoT is really all about. With the help of Bjarke Gotfredsen, CEO and co-founder of XinaBox, here is an introduction to IoT.

1. **What is it?** The Internet connects humans to each other and to lots of information. Did you know that bitcoin was the most searched "What is" definition on Google in 2018 (in the U.S. and U.K.)? The Internet of Things takes that connectedness one step further, when not just humans but all our devices are connected to each other via the Internet. "IoT separates itself from other kinds of technologies in its connection to its environment," says Gotfredsen. "What that means is that compared to programming, big data and AI, IoT is connected to the real world. When you interact with IoT, you interact with devices and sensors that report real-life data and operate real-life equipment."
2. **How does that relate to coding?** Coding in the IoT environment is grounded in reality. "When we normally learn to program or code, we are using an interface to the real world based on keyboard/mouse as input and screens as output, so we typically code with simulated data, or by reading data from the internet somewhere," notes Gotfredsen. "When we learn to program or code in an IoT-activated environment, it is the real deal. We are interacting with the real world, we are reading real temperature, light, gas and other measurements. The students can interact with the sensors, blow on a humidity or CO2 sensor, cover a light sensor or use their smartphone torch. It brings the surroundings alive."
3. **Why is the Internet of Things so powerful?** Breaking down the actual term, the "Internet" portion means that something is connected to the Internet, not just connected to a network. The "Things" of the term refers to those

devices connected to the Internet. “The strength of a device or thing connected to the Internet comes in its ability to learn how to behave,” says Gotfredsen. “For example, a thermostat connected to the Internet will send data to a central server. Software on the central server will recognize patterns in the thermostat’s operation and compare it to a million other thermostats. This enables the thermostat (either directly or through the vendor’s software developers) to get better in operation. It can warn the user of bad operation — maybe the thermostat is not located properly or some other malfunction, and the owner can be notified. Also, the thermostat can operate together with other thermostats in the same building to coordinate operation. Finally the thermostat can look up the outdoor weather and anticipate a heat wave or cold front and adjust its setting accordingly, preempting a major temperature change in the building.”

4. **What devices are considered part of IoT?** There are typically two sets of IoT devices, notes Gotfredsen. They are “the sensors that simply report back on the environment; and the output or control devices that can turn on/off or regulate actual hardware, such as lights, irrigation, pumps, as well as integrate divides, such as your oven, air conditioning and alarm system.”
5. **What skills should high school students who are interested in IoT be learning?** “Programming, programming, programming! Without that specific skill, everything else is secondary,” urges Gotfredsen. “Once programming or coding is as natural as your mother tongue, it’s time to specialize. Students can [focus on] data analytics and stats, or machine learning and pattern recognition. There are also lighter skill sets, such as GUI (Graphical User Interface – Web interfaces, and so on), or mechanical work in order to implement the IoT into the real world. Math is also important, but not heavy math.”
6. **How does data analytics fit into IoT?** “While individual IoT readings are light on data, the accumulated amount of IoT data is just so huge that business intelligence, data analytics, stats, AI and machine learning are essential in order to reduce the amount of data into a size that can result in decision making,” explains Gotfredsen. “Handling of big data, including data analytics, will keep becoming more important as more and more devices connect in an IoT world and generate more data.”
7. **Any last thoughts about the future of IoT?** “IoT devices consume less and less power,” observes Gotfredsen. “We are able to generate the small amount of needed power from places like the power collected by our shoes when we walk and the vibration from a car passing by. IoT devices will be implanted everywhere! Understanding low-power consumption and generation is a vital skill – at least for a while.”