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‘Sense and Avoid’ Drones.

Unmanned aerial vehicles, or drones, have become an important and controversial part of military capacity in recent years. They are also used in agriculture, for filming and multiple other applications that require cheap and extensive aerial surveillance. But so far all these drones have had human pilots; the difference is that their pilots are on the ground and fly the aircraft remotely.

The next step with drone technology is to develop machines that fly themselves, opening them up to a wider range of applications. For this to happen, drones must be able to sense and respond to their local environment, altering their height and flying trajectory in order to avoid colliding with other objects in their path.

In nature, birds, fish and insects can all congregate in swarms, each animal responding to its neighbour almost instantaneously to allow the swarm to fly or swim as a single unit. Drones can emulate this.

With reliable autonomy and collision avoidance, drones can begin to take on tasks too dangerous or remote for humans to carry out: checking electric power lines, for example, or delivering medical supplies in an emergency. Drone delivery machines will be able to find the best route to their destination, and take into account other flying vehicles and obstacles. In agriculture, autonomous drones can collect and process vast amounts of visual data from the air, allowing precise and efficient use of inputs such as fertilizer and irrigation.

In January 2014, Intel and Ascending Technologies showcased prototype multi-copter drones that could navigate an on-stage obstacle course and automatically avoid people who walked into their path. The machines use Intel’s RealSense camera module, which weighs just 8g and is less than 4mm thick. This level of collision avoidance will usher in a future of shared airspace, with many drones flying in proximity to humans and operating in and near the built environment to perform a multitude of tasks.

“Drones can begin to take on tasks too dangerous or remote for humans to carry out."

Drones are essentially robots operating in three, rather than two, dimensions; advances in next-generation robotics technology will accelerate this trend.

Flying vehicles will never be risk-free, whether operated by humans or as intelligent machines. For widespread adoption, sense and avoid drones must be able to operate reliably in the most difficult conditions: at night, in blizzards or dust storms. Unlike our current digital mobile devices (which are actually immobile, since we have to carry them around), drones will be transformational as they are self-mobile and have the capacity of flying in the three-dimensional world that is beyond our direct human reach. Once ubiquitous, they will vastly expand our presence, productivity and human experience.

Google X, the secretive lab behind projects like Google Glass and Google's self-driving cars, announced its latest project today: balloon-powered Internet access for those areas of the earth where regular terrestrial Internet isn't a good option. Earlier this week, Google started testing these balloons, which are meant to provide Internet access comparable to 3G networks while sailing the stratospheric winds, in New Zealand.

We had previously heard rumours about this, but just like most of Google X's projects, this idea sounded like a long shot. Using free-flying balloons, after all, sounds like a recipe for disaster – or at least for run-away balloons.

Because the whole idea sounds a bit crazy, Google says, it's calling this initiative "Project Loon." Google, however, believes that it has found a way to let these balloons "sail freely on the winds" and steer them by moving them up or down to catch the right winds. This still means the team has to manage a fleet of these balloons – and the idea here is to one day have these fly these around the world. Google says it's solving this problem "with some complex algorithms and lots of computing power." Google uses wind data from the National Oceanic and Atmospheric Administration to predict the balloons' flight paths.

Currently, Google says it is using 30 balloons in this pilot project and about 50 testers in New Zealand are using the service on the ground. These testers have special antennas that can connect to the balloons when they are within a 20km radius.

Google, and its chairman Eric Schmidt in particular, have long been talking about the importance of getting those two-thirds of the earth's population who don't currently have Internet access online. Project Loon is meant to help solve this problem, Google notes. Not only could it bring Internet access to areas where today's technologies don't work well (jungles, archipelagos, mountains).

"Google also hopes that this balloon-powered network can help bring down the price of Internet access in many counties where it is unaffordable for many people"