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THE BEST OF BOTH WORLDS

VERTICAL TAKE-OFF AND LANDING UAVS COMBINE THE STRENGTHS AND OVERCOME THE WEAKNESSES OF MULTIROTOR AND FIXED-WING UAVS, SAYS ADYASHA DASH

The world's urban population is growing rapidly: 66% of the world's population will be urban-dwelling by 2050, adding 2.5 billion people in total. The challenges that this poses for urban planning and resource management are enormous – from health issues such as ensuring households have water and access to sanitation to environmental issues such as preventing resource depletion, waste management and ecological disruption.

By 2050, 120 million hectares of natural habitats will be converted to farming in developing countries. And yet, current agricultural land doesn't reach its potential, yielding 50 percent less than what they produce. At the same time, about 795 million people of the 7.3 billion people in the world, or one in nine, suffer from chronic undernourishment.

This increase in urban population also has far reaching consequences beyond the confines of populous cities. The continuing increase in greenhouse gases has resulted in the polar ice caps melting faster in the past 20 years than the past 10,000. In fact, melting ice from both poles has been responsible for a fifth of the global rise in sea levels since 1992, with two-thirds of the ice loss happening in Greenland. How can we keep up with a rapidly growing population while working in harmony with our environment? Could efficient planning with the help of technology be the solution?

Wingtra, a start-up from Switzerland that specialises in building professional UAVs for these applications certainly thinks so. One of our core beliefs is that the availability of reliable, comprehensive and easily available data will lead to better decisions and empower people to work better together with their environment and with each other.

"We are proud to call groups ranging from surveyors and farmers to ecologists, glaciologists and wildlife scientists our customers," says Basil Weibel, our CEO.

Traditionally in the surveying industry, surveyors have measured their sites by foot, which is both time-consuming and dangerous. However, surveyors are increasingly turning to UAVs for their higher safety of operation and the ability to obtain accurate imagery efficiently. They are now used for urban planning, environmental studies, construction site

monitoring, feasibility studies and regulatory compliance. Orthomosaics and 3D models of the site help engineering offices, councils and quarry operators to plan and monitor.

But with so many UAVs on the market today, the question is: which serves the needs of the professional user best?

Multirotors v fixed-wings

UAVs are broadly grouped into two categories: multirotors and fixed-wing UAVs. Both have their own strengths and weaknesses. Multirotors can take off and land almost anywhere, but typically suffer from low battery life – popular quadcopters only fly up to 25 minutes on a single battery, for example.

Fixed-wing UAVs are arguably better when it comes to battery life and offer much higher ranges, but professional users typically use multirotors, even though they have to swap batteries far more often, as fixed-wing UAVs have strong limitations in terms of usability. Larger fixed-wing UAVs need catapults to take-off, which are cumbersome. But while smaller fixed-wings can be hand-launched, their smaller size makes them particularly prone to vibration and wind, reducing image quality and stability. They can also only carry lighter weights, which means they can only be equipped with lower quality cameras.

Whatever their size, fixed-wing UAVs have to 'belly land' after a flight. This increases wear and tear on the UAV and can potentially damage their expensive payloads.

The best of both worlds

A new option for professional users that overcomes the weaknesses of both multirotors and fixed wing aircrafts is the hybrid UAV capable of vertical take-off and landing (VTOL). This combines the strengths of fixed-wing UAVs and multirotors, by taking off and landing vertically like a multirotor but transitioning into fixed-wing mode once in the air.

Runways and catapults are unnecessary for a VTOL UAV, as it can easily take off and land anywhere, just as a multirotor can. But as it flies like a fixed-wing UAV, it has the same high speed and long range that it does.

Our chief product, the WingtraOne VTOL UAV, takes off from the ground directly with a press of a button – just as a traditional multirotor would – and so can be used wherever the operator is. But it can carry heavier, high-end cameras than a multirotor can, for better image quality and resolution, and as it doesn't have to belly land, the cameras are well protected at all times. It can also fly for 55 minutes on a single battery, thanks to the aerodynamic efficiency of its wing.

Environmental applications

Aerial imagery has been proving to be an invaluable tool in precision farming. Estimates show that with precision farming, the application of fertilizers containing nitrogen and phosphorus to wheat, rice and maize could be reduced by 13-29% while still producing the same crop yields.


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Currently, although the focus for precision farming is on covering large areas, farmers are reluctant to use fixed-wing UAVs due to their usability limitations. But the VTOL UAV could change that, enabling farmers to obtain sufficient data from wider areas and thus make further efficiency gains by adjusting the timing, placement and type of fertilizer.

At another extreme, glaciologists working near the polar regions face some unique issues. These include uncertain temperature ranges, high wind, and routine failure of traditional sensors such as magnetometers.

The WingtraOne's high payload capacity and more powerful motors come in handy in this case, since it can't be blown away by updrafts and can land in strong wind. Control algorithms ensuring that it retains enough stability and powerful actuation retains enough control authority that it can still take off, hover, fly and land in these extreme conditions. Intelligent estimation algorithms ensure that temperature variations or failure of sensors do not deter it from flying safely either.

Turning information into insight

Ultimately, data is just another tool – although a rather powerful one. Without human intelligence, empathy, and ingenuity even the best of tools become useless. With comprehensive data, humans can make better decisions that benefit the environment while benefiting from it at the same time. With a deeper understanding of our own surroundings – be it dense urban spaces, vast agricultural lands or the uninhabited poles – we can all become more resource-effective at a local level, directly impacting the global environment positively.

RUNWAYS AND CATAPULTS ARE UNNECESSARY FOR A VTOL UAV

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