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Abstract:

The unmanned systems lab at Middlesex University was set up to investigate the design, development and use of novel and creative unmanned systems for applications in the fields of Military, Security and Civilian areas. We specialise in small VTOL UAV systems, but also have ongoing research into the trafficability of unmanned ground vehicles and stand alone sensor systems.

Detailed research information:

Over the last 18 months and with the backdrop of the Ministry of Defence's (MoD) Grand Challenge competition 2008 entry we have built a proof of concept UAV which has significant novel features in terms of its physical size and payload capability which far exceeds its main competitors in the global market. The intellectual property inherent within this prototype has been protected by a Patent Pending, Registered Design and Trademark (HALO™).



A great deal of fundamental research has been conducted into the central element of this novel solution in terms of the co-axial rotor drive units. The growing threat of terrorist attack has prompted the military and security agencies in the UK to upgrade their available equipment and to source systems that can operate remotely and autonomously. The design of this unique tri-rotor concept allows these agencies access to a platform which currently only exists in a very limited range of commercial suppliers outside of the UK and at high expense. Our system also has great potential in terms of the civilian market for applications such as forest fire detection, environmental monitoring, sporting event filming, pipeline inspections, crime scene investigation and many more.

Unmanned Ground Vehicle's (UGV) have to cope with the most complex range of dynamic and variable obstacles and therefore need to be highly intelligent in order to cope with navigating in such a cluttered environment.



When traversing over different terrains (whether it is a UGV or a commercial manned vehicle) different drive styles and configuration settings need to be selected in order to travel successfully over each terrain type. These settings are usually selected by a human operator in manned systems on what they assume the ground conditions to be, but how can an autonomous UGV 'sense' these changes in terrain or ground conditions? This research will investigate non-contact acoustic sensor technologies and how they can be used to detect different terrain types by listening to the interaction between the wheel and the terrain. The results can then be used to create a terrain classification list for the system so in future missions it can use the sensor technology to identify the terrain type it is trying to traverse, which creating a more autonomous and terrain capable vehicle. The technology would also benefit commercial driver assistive technologies.

In terms of a fixed sensorized platform, the Unmanned Systems Lab has teamed up with elements of the Metropolitan Police to develop a Pole Climbing Camera system we call PC-101.



After extensive field research had been carried out on a range of street furniture, the design specification became very clear. Lamp posts are the most common type of street furniture which can be seen at nearly all crime scenes. 98% of all lamp posts within the Metropolitan Police Area are metallic and come in various different profiles and heights. On average the height is between 6-10 m high, and may be tapered, with a cross section that is non-circular. A major issue when climbing up a lamp post within the Metropolitan Police Area is the amount of obstructions on many of the high street lamp posts. So the climber that Middlesex designed had to be able to tackle any of these assorted lamp posts without modification or adjustment.

The Middlesex Team began the design process with an idea generation session which led to the development of the robotic pole climber platform known as PC-101. The innovative aspects of PC-101 are its ability to climb up on a single side of any metallic lamp post whilst avoiding any obstructions on the other side. Via the use of an articulated arm, which carries the gimbaled payload sensor (digital camera), PC-101 is able to get an unobstructed 360° view of the whole area no matter which side the PC-101 has climbed up. The unique IP vested in the platform has been protected via a Patent Pending (GB 0909358.4) to protect the concept of climbing up metallic surfaces with magnetic wheels. The applications for a robot of its kind have many possible applications which will change the way certain tasks will be carried out by the Police and Security Forces in the near future. We are also in the process of applying to trademark the name PC-101 for this device.