Next Generation Urban Search and Rescue Robotics

Warwick Mobile Robotics

The Team

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Aims

To design, manufacture and test an urban search and rescue robot tasked with locating and aiding those caught in disaster zones.

Objectives

1. To develop upon previous WMR Urban Search and Rescue (USAR) robotic projects and improve their rescue capabilities
2. Create a platform conducive to further development by future WMR project teams
3. To inspire the next generation to enter the remarkable world of robotics

WMR: Search & Rescue

What | Warwick Mobile Robotics is a research group at the University of Warwick specialising in the development of search and rescue robots for use in surveillance, disaster zones and safe monitoring of hazardous sites.

Who | The WMR Search and Rescue team comprises six 4th year engineering students studying a variety of disciplines within the School of Engineering.

Why | In natural disasters, such as earthquakes, robots can be used to find survivors.

Robots can be rapidly deployed into hazardous environments, reducing the risks to first responders and minimising rescue time.

The lack of financial incentives and opportunity for profit calls for academia to invest the time and resources to advance the field of urban search and rescue robotics.

Inspiring Others

Inspiring the next generation

The team have been showcasing WMR robots at events such as the Festival of the Imagination 2015 and Imagineering 2015.

Programming

Using Scratch to teach children what can be achieved within robotics using our robots Custard and Cream.

The team talking about Custard and Cream

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School of Engineering

TransDev THE POWER IN MOTION

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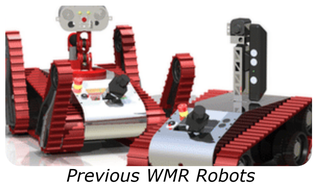
Project Timeline

Project Commences	Aims and Objectives	Complete Benchmarking	Submit Detailed Designs	Start Manufacture	Assembly	Testing	Project Evaluation	Technical Report	Project Complete
29 Sept 2015	6 Oct 2015	25 Oct 2015	11 Jan 2016	25 Jan 2016	14 March 2016	28 March 2016	18 April 2016	05 May 2016	15 May 2016

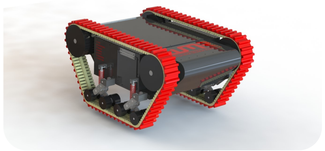
Introducing Cyclone

This year the WMR team are building on the work of the 2014/15 project, Orion. After benchmarking, a variety of changes were made including a systems approach during the design stages of Cyclone. By the end of the project year, the team aims to have a mobile, multi-terrain robot that future teams can to expand upon for the development of Search and Rescue.

Still using technology from previous designs such as the Light Detection and Ranging (LiDAR) device, significant changes have been made to the robot's chassis to increase stability over rough terrain. The robot is now operated by a games console controller for ease of use. The modular design will allow future teams to expand on the robots capability.



Previous WMR Robots



Orion, WMR 2014/2015 design

Cyclone, WMR 2015/2016 design

Mass | 17.2kg
Range | 80-100m
Battery Life | 55 minutes
Dimensions |
64cm x 38cm x 33cm

Mechanical Innovation

Modular Chassis

Lightweight | Geodesic latticing of aluminium sheets has reduced the previous design's weight by 20% with a stiffer and stronger structure.

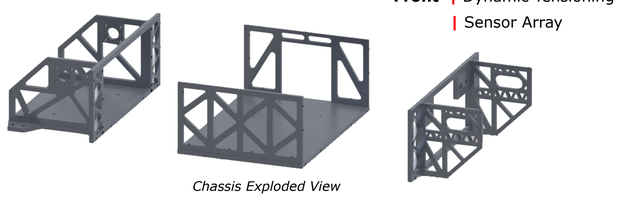
Modular | The chassis is divided into three pre-assembled modules that can quickly be separated to allow for modifications.

Adaptable | Future teams can easily replace individual modules to alter the robot's functionality.

Back | Drivetrain
| Suspension

Middle | Electronics
| Communications

Front | Dynamic Tensioning
| Sensor Array



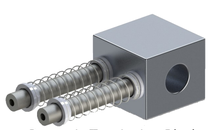
Chassis Exploded View

Dynamic Tensioning

Stable | Designed to prevent low track tension and avoid track derailment from the drive wheels.

Flexible | Allows for independent tension control of each track.

Reliable | Works in conjunction with suspension to avoid track failure.



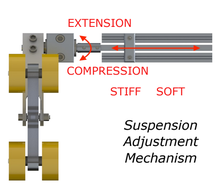
Dynamic Tensioning Block

Suspension

Responsive | The suspension gives the robot more grip and a smoother ride over changing terrain.

Robust | Torsion blades reduce the number of moving parts and simplifies linkages making components easy to manufacture.

Adjustable | The effective length of the blades can be altered to increase or decrease the spring stiffness and raise or lower the ride height.



Suspension Adjustment Mechanism

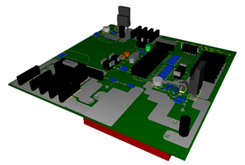
Electrical Innovation

Battery Monitoring

User Friendly | Includes both a hardware and software display of the current power status including alerts.

Safety | The robot will safely shut down if 'heartbeat' communications with a sub-system fails.

Low Cost | The design is based on low-cost and commercially available components.



Battery Monitoring Board

Drivetrain

Manoeuvrable | Improved parallelogram profile gives larger ground contact for increased traction and enhanced climbing capability.

High Efficiency | 94% efficient motors coupled with 84% efficient gearhead meaning little power is wasted.

High Power | A high torque and low RPM enables the robot to easily traverse tough terrain.

Control | A tight turning circle is possible as each track is individually driven by the PS3 controller's analogue sticks.

Gearhead and Motor Assembly

Summary

Teamwork

Since the beginning of the project, the team has worked well together to ensure deadlines are met.

Mechanical and Electrical Integration

System integration and future planning has been recognised from the design stages.

Innovating Designs

The following concepts were developed in this project year and are currently going through manufacturing.

Working Controls and Wireless Communication

The wireless communications between the motors and PS3 controller has been successfully established.