ATLAS

Urban Search and Rescue Robot

WMR — Warwick Mobile Robotics

Aim

Our aim is to design and manufacture an urban search and rescue robot capable of locating and assisting the victims of disaster zones. This robot has been named ATLAS.

Project Commences	Aims & Objective	Ten Stage Plan	Research on Suspension System	Submit CAD Drawings	Old Components Testing	Manufacturing Commences	Assembly	Testing	Automation	Technical Report	Project Completion
30 Sept 2016	4 Oct 2016	10 Oct 2016	15 Oct 2016	7 Dec 2016	20 Dec 2016	9 Jan 2017	1 Feb 2017	1 Mar 2017	10 Mar 2017	4 May 2017	12 May 2017

Scope

Previous WMR projects prioritised highly complex designs. As a result, their robots were unable to reach the completion stage; leaving behind highly specialised components that could not be formed into a foundation for future projects.

We aim to correct this.

Inspired by the best aspects of previous WMR projects, ATLAS has been built from the ground up as a highly functional robot that will

Objectives

1. Design and manufacture a functional robot for future Warwick Mobile Robotics teams to build and improve upon.
2. Improve and optimise the simplified, functional components of ATLAS through the use of iterative design methodology.
3. Facilitate external funding through sponsorship and improved company relations to assist in future projects.
4. Develop an intelligent robot to compete in the international RoboCup Search and Rescue competition to assess the robot within realistic disaster scenarios.

**"The Simplest Solution is Usually the Correct One"**
Occam's Razor, 1285–1347

WMR 10 Stage Plan 2016/17

1. Creation of organised communal workspace.
2. Reverse engineer previous successful robots, recycling parts and addressing flaws.
3. Design and manufacture chassis and rigid axle system.
4. Develop main drive track and basic motor control.
5. Develop rotating track arm motor system and control.
6. Implement and test a spring-damped suspension system.
7. Implement and test dynamic-tensioning system for tracks.
8. Incorporate basic sensing equipment.
9. Mount sensing equipment on a simple arm design.
10. Test ATLAS in a simulated real-word environment.

"Form Follows Function"
Louis Sullivan, 1896
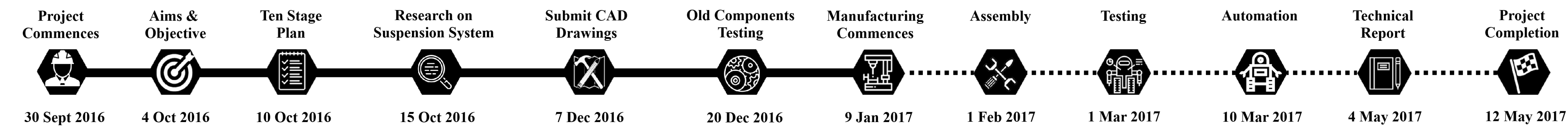
Functionality

Durability | Variable thickness aluminium sheets to prevent deformation upon collision.

Size | Stable platform for use of an articulated arm and reduced vibration to give stable video feed and telemetry.

Accessibility | Hinged door provides easy access to internal hardware for maintenance and modifications.
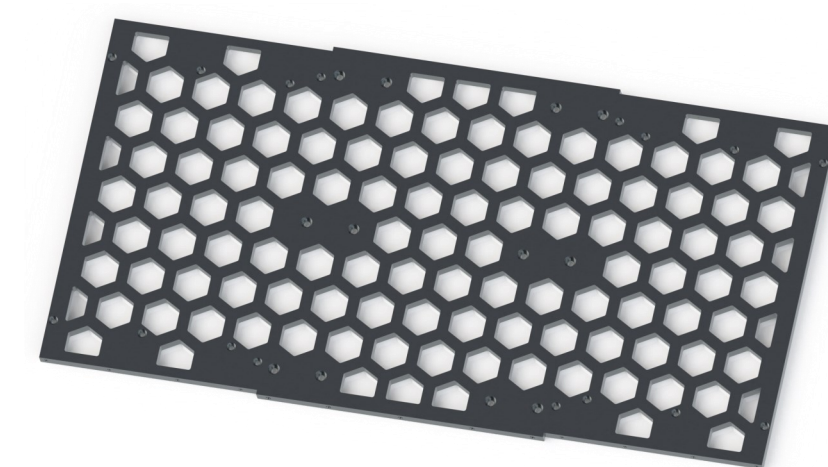
Honeycomb lightweighted chassis baseplate

Chassis

Readiness | Cladding protects robot from real-world fluids and particulates. Half turn latching mechanisms allow for ease of access.

Lightweight | Stiff honeycomb structure reduces weight whilst distributing stress concentrations.

Efficient | Placement and attachment of components maximises space, ease of access and heat removal from the system.

Communication & Control

Connection | Operates through a local Wi-Fi router with minimal setup required.

Long Range | Extendable network range using multiple routers as signal boosters to achieve data package 'hopping'.

Customisable | Motors and different sensors can be added using Arduino nodes as well as USB ports on
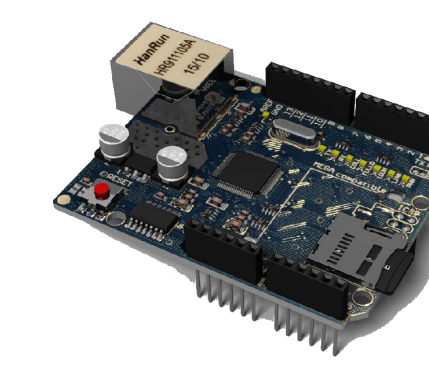
Software & Control

Clear Control | ATLAS utilises a game controller to manipulate speed and direction through the use of two joysticks for stable, variable control.

Software | Robot Operating System (ROS) for reliable device control, information and package management between the laptop and the on-board Pico computer.
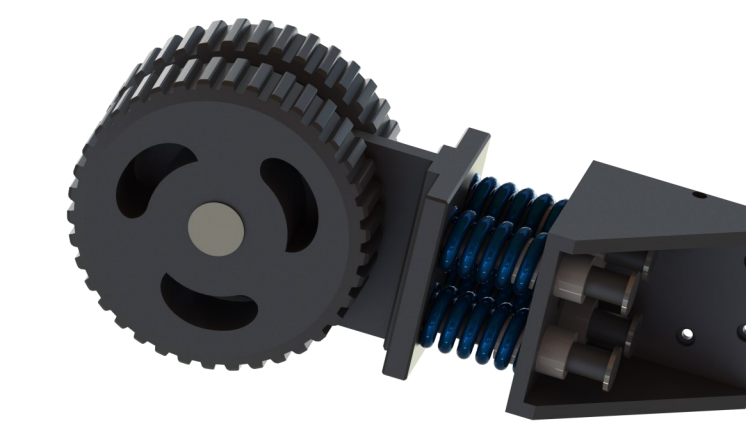
Arduino | Speed variation performed by controlling power distributed to the motor controller using computed pulse-width modulated signals (PWM).

Sensors

LiDAR | High accuracy, resolution and wide angle detection maps ATLAS's surroundings.

IMU | Used in conjunction with the LiDAR to determine ATLAS's position and orientation, to enhance the mapping capabilities.

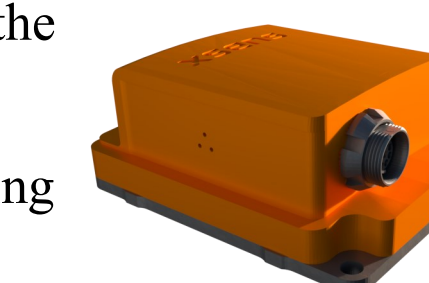**CO_2** | Allows ATLAS to detect survivors by monitoring breathing patterns.

Arduino microcontroller

Inertial Measurement Unit (IMU)

Tensioning system

Contact | Manually-adjustable static tensioning system keeps the track taut around the wheels.

Rigid | High stiffness springs across all four pillars distribute high loads when the robot experiences impacts.

Positioning | Compact assembly that sits behind the wheel to maximise stiffness.

Adaptable | This system works in tandem with the suspension system to ensure the track remains on the wheels, while maintaining an optimal tension level on the track.

Dynamic tensioning system

Suspension

Stability | Initial phase design implements a solid based suspension to provide simplicity and strength.

Modular | Suspension is removable for ease of repair.

Dynamic | Adaption from solid suspension to full spring-damped suspension through iterative development and testing.

Spring-damped suspension system

Meet the Team

[Oliver Mackinnon] Project Manager Dynamic Tensioning

[Dan Carmichael] Chief Design Engineer Modular Suspension

[Andrew Gilley] Secretary Chassis and CAD

[Michael Rajaretnam] Health & Safety FEA and Lightweighting

[Guy Baker] Finance Manager Power System

[Thandi Ngoma] Media & Marketing ROS Programming

[Adam Hong] Outreach Officer Communications

[Emma Rushforth] Project Supervisor Robotics Expert

Benefits to Society

**Inspiring the Next Generation**

The team have promoted the development of autonomous robots, especially for use in rescue efforts at disaster sites via the outreach programme:

- Formatively raising awareness of robotics and engineering among youngsters: Imagineering, WMG open-days 2016/17, Warwick Technology Conference, Regional Robotics Seminars.
- Pioneering Research: RoboCup and DARPA.

Commercial and Business Operation

- Operation within disaster zones is: safer, more reliable and deployment is faster. The robot is replaceable and easier to maintain than a human workforce as exhaustion is removed.

Into the Future
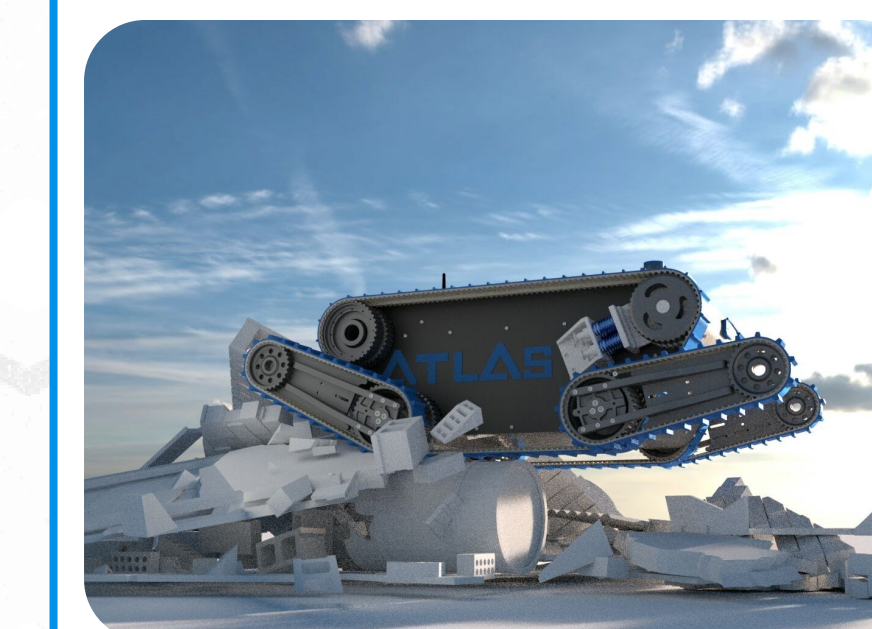
ATLAS is a platform on which the future teams of WMR can build upon. The team, upon completion, will have a mobile real-world tested robot with basic sensing capabilities. It is believed that future teams can focus primarily

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