Urban Search and Rescue Robot (20)

Warwick Mobile Robotics

WMR

Warwick Mobile Robotics (WMR) are creating an Urban Search and Rescue Robot (USARR), ATLAS Legacy. It will be designed and manufactured to be robust, dexterous and capable of finding victims in disaster zones.

Scope

Using the foundation of the 2016/17 robot, ATLAS, this year's WMR team aim to continue this legacy.

ATLAS Legacy will be built with a robust, modular chassis and detachable robotic arm whilst implementing a full sensor sweep. Additional focus will be placed on the light weighting of the previous year's foundation.

Objectives

- Develop a wirelessly controlled robot.
- Design and build a safe and stable power regulation system.
- Improve the robot's dexterity through a newly designed robotic arm.
- Develop a more efficient and competitive lightweight structure.
- Build industrial links and relationships through company sponsorship.
- Facilitate future WMR projects by providing detailed handover documentation.

Timeline

Create Aims → Build Links → Designs → Assembly → Events → Robot Testing → Quality Control → Competition → Handover

Electronics

Power System

Lithium Polymer (LiPo) → Batteries make up the robot's power supply.

Emergency Power Supply → To allow communication should main battery power fall short.

Emergency Stop → Included for increased safety.

Instrumentation

LIDAR → Measures separation between obstacles and robot with the use of light.

Camera → To give real-time site image to remote operator.

Accelerometer → Measure Speed Control.

CO_2 → Detect survivors.

Temperature Sensor → Measures the surrounding temperature for habitability.

IMU → Determining Legacy orientation in conjunction with the LIDAR.

Control Systems

Field-Programmable Gate Array (FPGA) → Highly flexible and modularly programmable, using Xilinx Design tools and Verilog.

Pico842 → Small computer running Ubuntu (Operating systems).

Wi-Fi → Between remote operator and robot established through WIFI router and base computer for control.

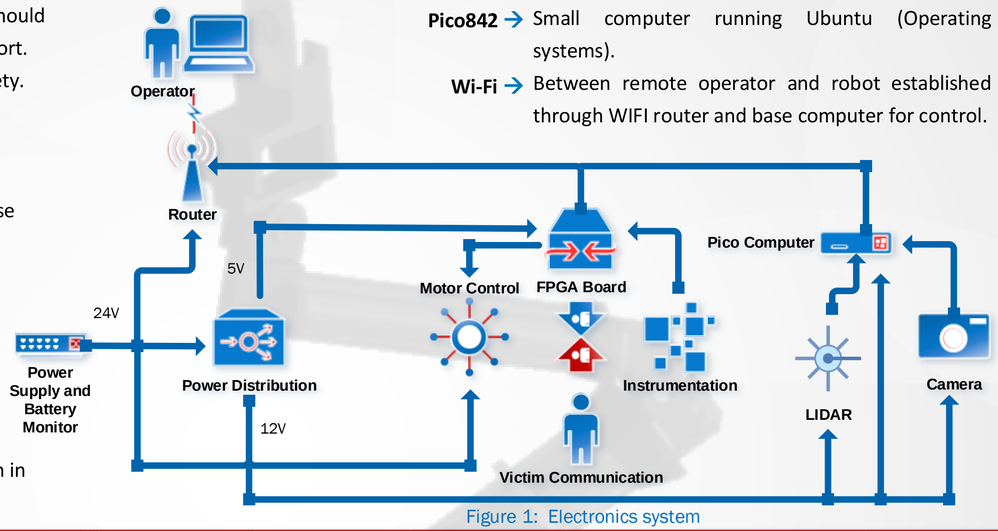

Figure 1: Electronics system

Mechanics

Light Weighting and Optimisation

Figure 2: Robot arm CAD design

Reduce Weight → To improve the speed and manoeuvrability, whilst retaining its strength and durability.

Hinged Side Panel → For simple removal and adjustments of internal elements.

Sliding Battery Holder → Allows for easy access to batteries.

Electronic Box → Control hardware stored within for safety and ease, allowing for modifications to be made.

Robotic Arm

Redesigned → Lighter and smaller than previous arms, to reduce robot weight and increase agility.

Aluminium Tubing → To reduce costs and be simpler to replace.

End Effector → More functional and easily controllable.

Figure 3: Atlas Legacy

Drive Improvements

Tensioning System → Designed to incorporate four springs on each of the robot's main drive tracks. Ensure the tracks are correctly taut around the wheels. Leading to increased traction, controllability, reliability and speed.

Breakable Drive Shafts → In the event of large forces passing through the chassis the shaft will break instead of deforming and damaging the gearboxes and motors. The shaft is easily replicable; is a failsafe safety feature.

Stronger Mounting → Redesigned to be stronger, more durable and more secure.

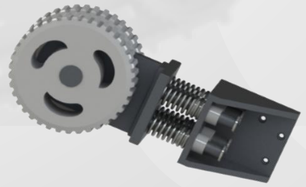

Figure 4: Track tension system

Team

Charles Perera, Project leader
Jan Specht, Coordinator
Eashana Chotai, Secretary
Mark Safford, Finance
Emily Carman, Health and Safety
Tom de Oliveira, Procurement
Bálint Vidos, Sponsorship
Emma Rushforth, Project Supervisor

Benefits to Society

Operation of USAR improves response to natural disasters by: reaching disaster zones faster, reducing rescuers exposure to unsafe conditions, superior sensor capabilities and ability to create 3D maps of disaster areas.

The team are generating interest into USAR robot development and inspiring the next generation of engineers via outreach programmes:

- The Science gala and VEX robotics event to educate aspiring engineers, aged 13-18.
- University open days to raise awareness and promote the project.

Future

ATLAS Legacy will provide the foundation for future WMR projects to enhance upon. Future areas to be explored are: increased speed, achieving autonomy and controlling and operating the robot remotely through VR systems.

Figure 5: Future potential robot development

Contact Us

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www.youtube.com/WMRobotics
www.facebook.com/WMRobotics
www.instagram.com/mrobotics/

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