



WANDERER V2 (Code: WANDV2)

DESCRIPTION

The *WANDERER V2* is a three wheeled vehicle that changes direction if it bumps into an object. Each front wheel is driven by a separate gearbox/motor. The rear has a swivel mounted trailing wheel, allowing the vehicle to change its direction of travel easily.

The *WANDERER V2* is controlled by micro switches mounted at the front of the vehicle and activated by a bumper bar. When it encounters an object, one or both microswitches will operate and cause it to reverse and turn away from the object. There is a PCB and a significant number of electronic components controlling the vehicle.



LEVEL:

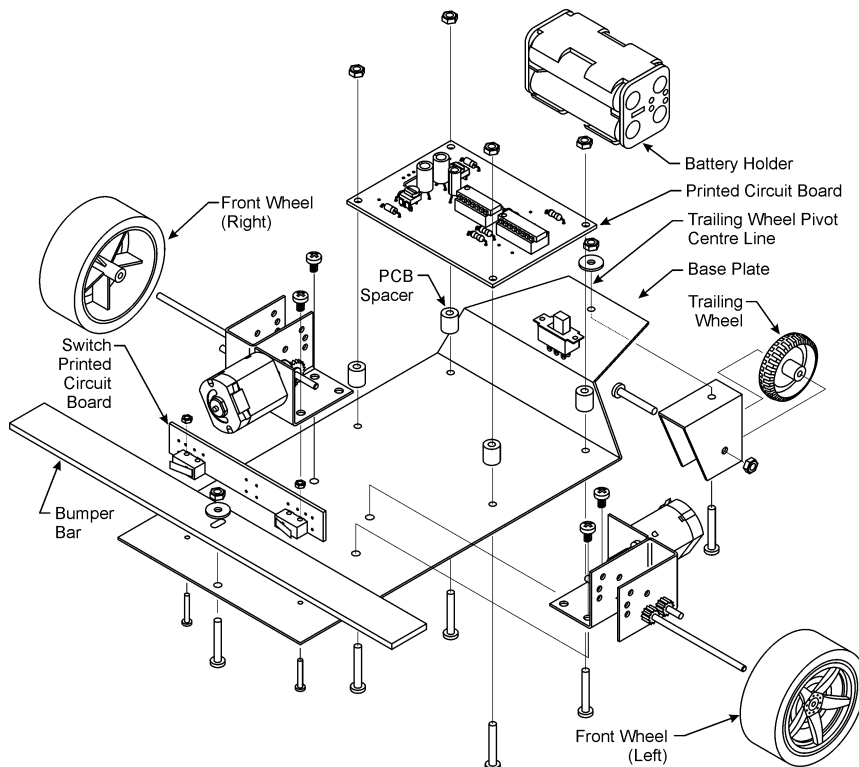
Advanced

HOURS TO CONSTRUCT:

23 -29 hours

SKILL DEVELOPMENT:

- Planning and Design
- Manufacturing
- Soldering
- Mechanical
- Electrical





WHAT'S IN THE KIT?

- All the mechanical, electrical and electronic components required to make the *WANDERER V2* work including PCBs, motors, gearboxes, shafts, wheels, battery holder and microswitches.
- A detailed teaching unit with a complete parts list, design suggestions, step by step instructions for soldering components onto the PCBs, gearbox assembly, and general construction guidelines.



WHAT ELSE IS NEEDED?

The following items are required and are available from Scorpio Technology, but need to be ordered separately:

- 4 x Battery – AA Alkaline (BATTALK or BATTALK40 for a pack of 40)
- Multi strand hook-up wire – in a variety of colours (WIREHU10)

The following material is to be supplied by the student / teacher:

- Material for the base plate, bumper bar and trailing wheel carrier (PVC or acrylic sheet, aluminium, plywood, etc.)
- Block of wood to support gear case at the assembly stage. At least 25mm thick, that holes can be drilled into

TOOLS REQUIRED

The following tools are required:

REQUIRED TOOLS	ORDERING CODE
Assorted hand tools (depending on materials chosen)	-
Small Phillips screwdriver	-
Ruler and pen	-
Craft knife	CRKNF
Soldering Iron and Soldering iron stand: – a good quality soldering iron, with a fine tip	SOLDIRN SOLDIRNSTD
Or	
Soldering station	SOLDSTN
Solder: – 0.71mm 60/40 solder is recommended	SOLD250/SOLD500
Wire strippers	WIRESTR
Side cutters	SIDECUT or SIDECUTM
Mini Bolt Cutters	BOLTCUTM
Drill Bit – 2.6mm	DB2.6
Drill Bit – 3.5mm	DB3.5

In addition, the following tools are useful to have and are available from Scorpio Technology, but need to be ordered separately if required:

- Component lead forming tool (for resistors, diodes etc.) (COMPLFT)
- IC Inserter (ICINSERT) / IC remover (ICEXTRACT) / IC straightener (ICSTRAIT)
- PCB Holder (PCBHOLD)



ABOUT THE PROJECT

The major features of this project are the planning, design, construction and assembly stages of an advanced vehicle.

PLANNING PHASE

Advanced projects such as the *WANDERER V2* require good time management from the student because of the number of components involved as well as the complexity of the project. Before commencing work the student should spend some time planning their project, drawing up a plan describing:

- The sequence of work that will be necessary to complete the *WANDERER V2*.
- A timeline showing the anticipated completion dates of each section of work.
- How the *WANDERER V2* operates.

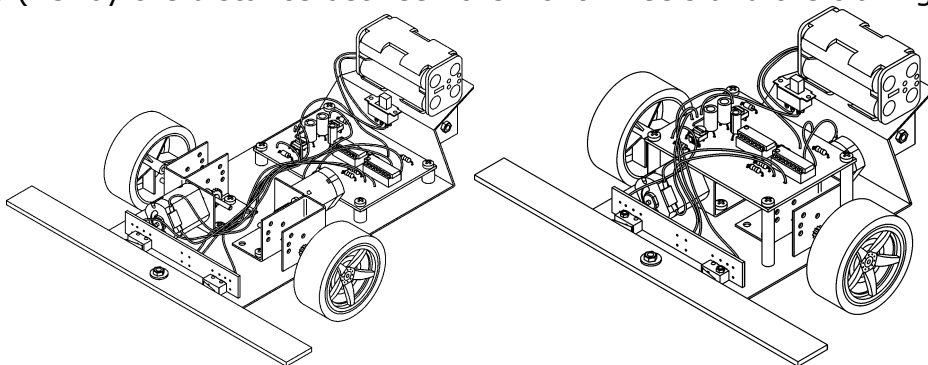
These plans should also take into account what items should be recorded throughout the life of the project. This may include maintaining a logbook, recording daily or weekly progress, problems encountered, measurements taken and observations made.

DESIGN PHASE

Create your own unique *WANDERER V2* design based on our drawings which focus on component relationships, rather than dimensions. This provides scope for students to individualise their *WANDERER V2* design and increase their engagement in the project.

During the **Design phase**, students will need to:

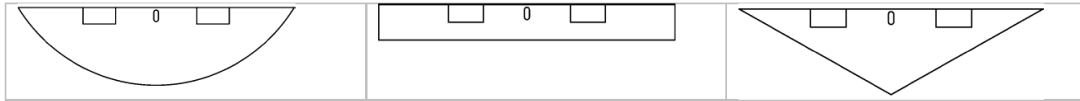
- Evaluate the suitability of various materials, such as PVC, acrylic, aluminium plate, plywood or balsa wood
- Look at the vehicle's length, balance, turning circle, component layout, space efficiency
- Investigate how the vehicle's manoeuvrability is affected by the length of the chassis (i.e. by the distance between the front wheels and the trailing wheel)



- Select a gear ratio – two ratios are available for the student to trade off speed versus torque and manoeuvrability
- Understand how the vehicle's manoeuvrability is affected by the time the motors stay in reverse (using the adjustable time delay)
- Understand why a 4 wheel design is not suitable (or for the more advanced, what is needed to make a 4 wheel design possible)
- Consider aesthetic questions, for example: Can the appearance be improved?



- Determine the shape of the bumper and the effect it will have on the performance of the *WANDERER V2*



IDEAS FOR OPTIONAL BUMPER BAR SHAPES

- Consider if the bumper should extend vertically to prevent the *WANDERER V2* from passing under an object that is too low?
- Evaluate available technologies that can be used, for example:
 - 3D printing
 - laser cutting (which allows more interesting shapes than usual)
 - vacuum former (if making an external shell)
- Consider the practical aspects of construction and assembly.

The above design considerations could also be part of a class challenge, for example, to design a vehicle that can navigate an obstacle course.

MAKING / CONSTRUCTION

Once the Design process has been completed, the students will be able to start **building their design**. They will:

- Make and assemble the *WANDERER V2* base plate/platform, trailing wheel carrier and bumper bar that they have designed
- Assemble and solder the main PCB and its components (resistors, diodes, capacitors, trimpots and ICs)
- Assemble and solder the bump switch PCB, and mount it in place
- Assemble and mount the two gearboxes
- Mount the PCB and all the other components to the baseplate
- Wire up the PCBs, microswitches and motors
- Test and adjust the *WANDERER V2* including setting the time delay for how long the motors will reverse
- Troubleshoot any problems!

DOES THE TEACHING UNIT INCLUDE ANY THEORY?

The Teaching unit has a THEORY section, which covers:

- How the *WANDERER V2* operates -
- How the *WANDERER V2*'s circuits work including:
 - The circuit and its sub-systems
 - The reverse delay circuit (RC circuit)
 - The Schmitt Trigger Inverter
 - The motor control circuit

