Build notes and setup instructions

1 Build notes

This is intended to accompany the main dissertation report and contains additional practical information for using the robot.

Figure 1 shows the (annotated) mid layer of the robot upon which most of the components are mounted. Figures 3a and 3b show the lower and upper layers respectively. Figure 2 shows the associated schematic of the full robot.

2 Setup instructions

Both switches can be removed e.g. for transportation to avoid accidentally turning the power on. The switch for the low level circuitry power can be connected (in the position shown in Figure 4a) either way around.

The switch for the computer connects to the voltage regulator (component 3 in Figure 1) and there is nothing physically preventing this from being connected the wrong way around. It should be connected as shown in Figure 4b/

If the Teensy is connected via USB (which it normally will be) AND the low level circuitry is powered on (which is normally will be) then the Teensy should not receive power on its Vin pin (see 5a). If, however, it is required to have the Teensy not connected/powered via USB (i.e. for using radio control only), then there is a wire coming from the low level power board that can be connected (it is currently the only unconnected wire present).

If using an external computer rather than the on-board Odroid, then the camera and microcontroller USB connections must go to that computer. These are the only changes required. In this case of course the Odroid power can be left off.

3 Limitations and improvements

1. The tracks do not have much grip on rigid surfaces e.g. the wooden stepfield upon which the robot was mainly being tested. This does somewhat limit what movements it is capable of.

2. The batteries are currently held on with zip ties. Although this is very simple, it does mean that they must be cut off and re-attached anytime the batteries need to be removed e.g. for recharging.

3. The radio shares the same power supply as the motors which can cause problems when they are drawing a lot of current. It appears that the voltage drop can be sufficient to reset the radio, at which point it may not be responsive (and the settings would need to be re-applied). This isn't a major issue since the radio is really only used for testing and the robot can just be driven slower, but isn't ideal.

4. The robot has a high centre of mass which has a negative impact on its stability if moving up/down slopes near its limit. This is compounded by the fact that the flat base part of the tracks are actually quite short. It does have the advantage of having a significant clearance between the tracks and under the body, so it is a trade-off.

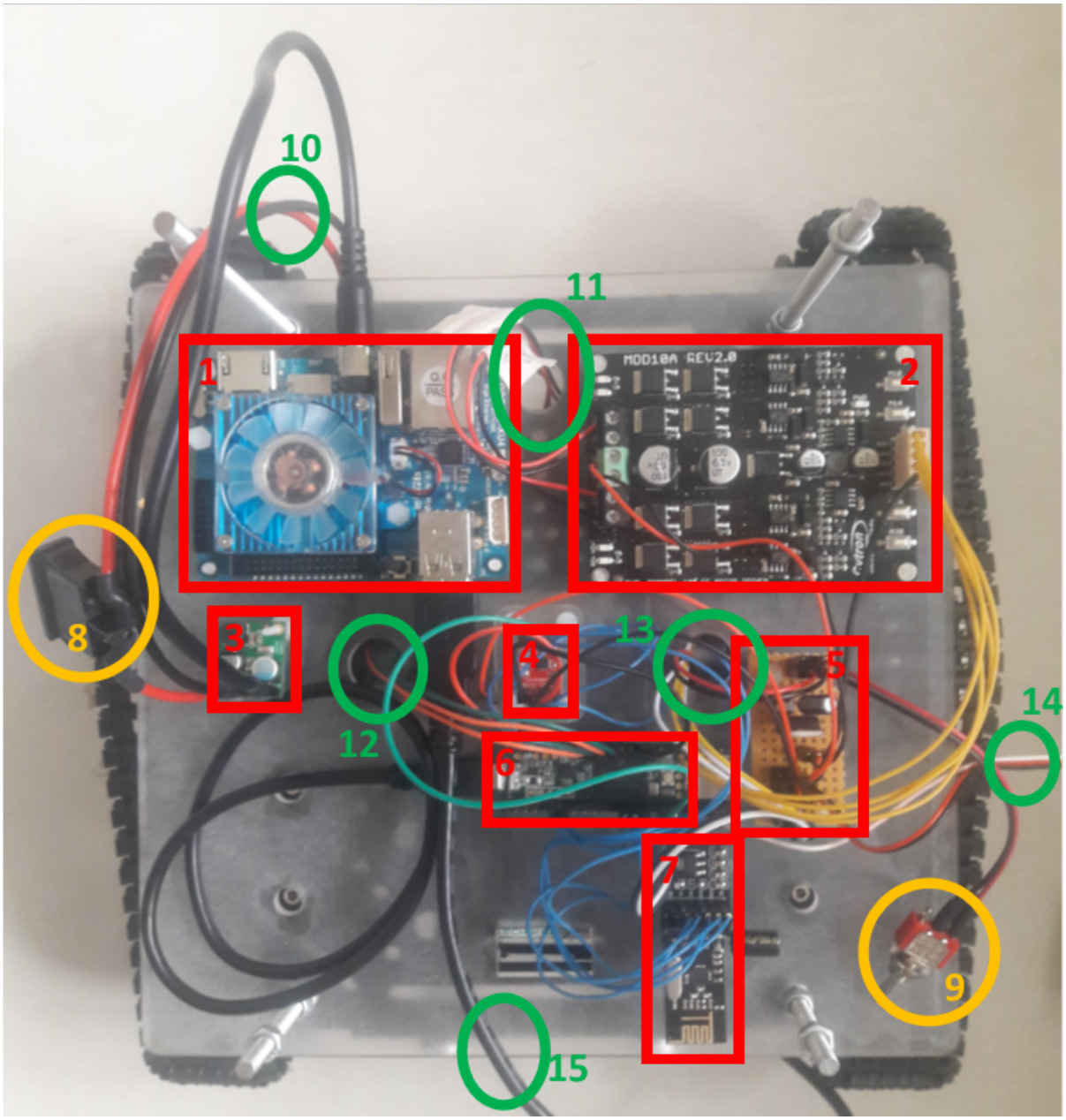


Figure 1: 1. Computer, 2. Motor driver, 3. Voltage regulator for computer, 4. IMU, 5. Voltage regulator and connections for remaining components, 6. Microcontroller, 7. Radio, 8. Switch for computer power, 9. Switch for low level circuitry power, 10. To computer/camera battery, 11. Through hole to motors, 12. Through hole to encoder sensors, 13. Through hole to encoder Vin/GND, 14. To servo, 15. To camera

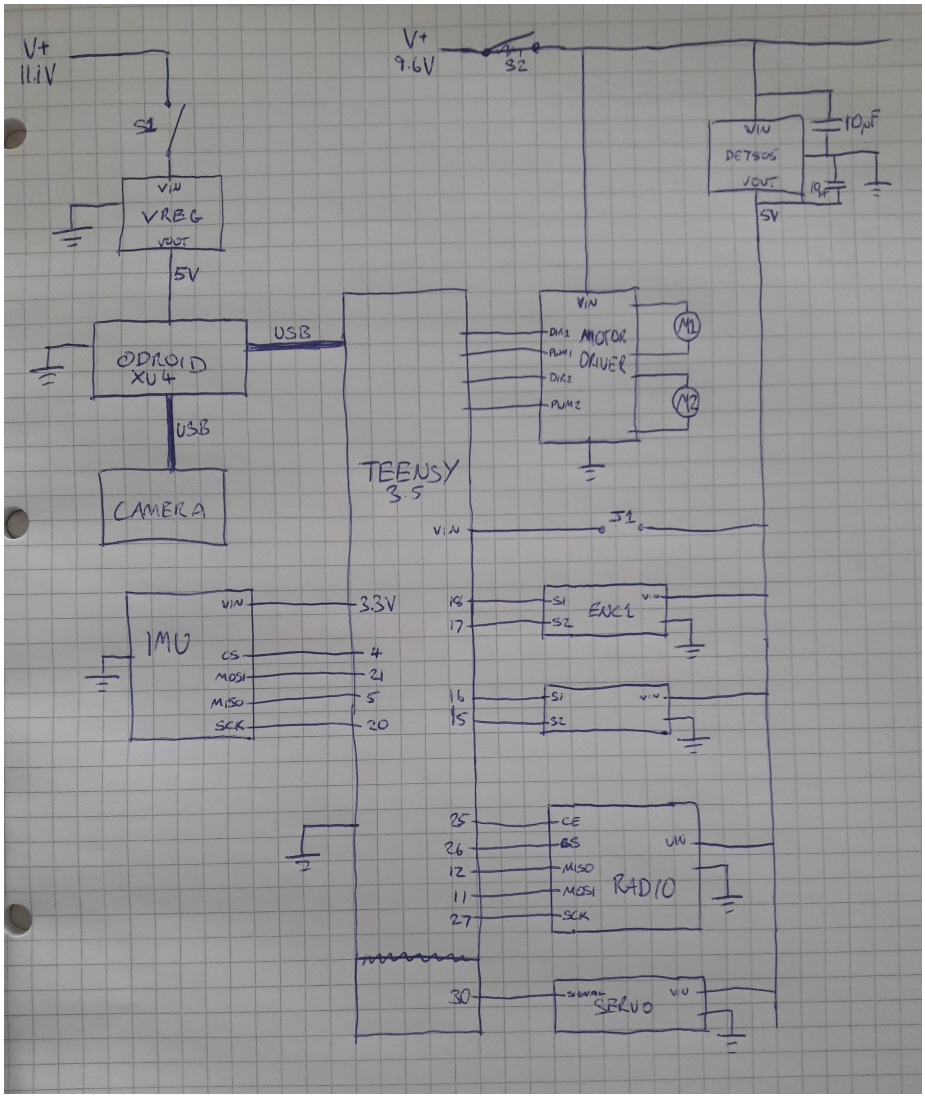
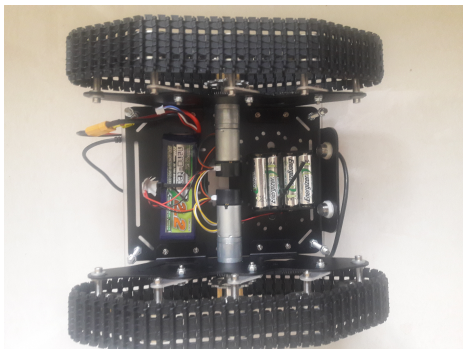
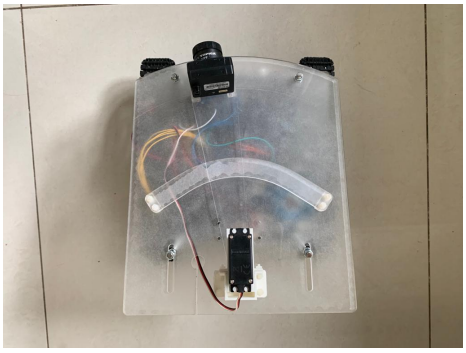


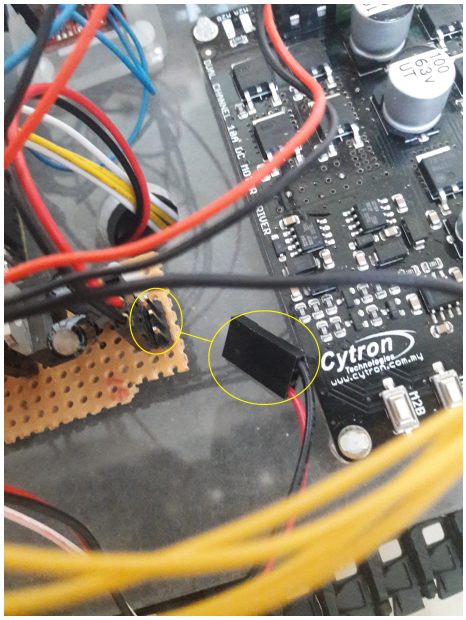
Figure 2: Circuit schematic for the full robot.



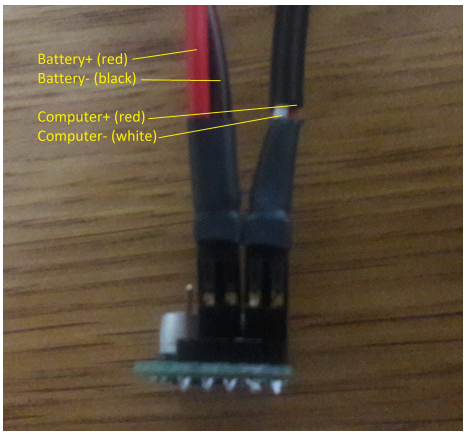
(a) Components on the underside of the robot - both batteries, motors and encoders. The protective lower sheet is not present in this picture.



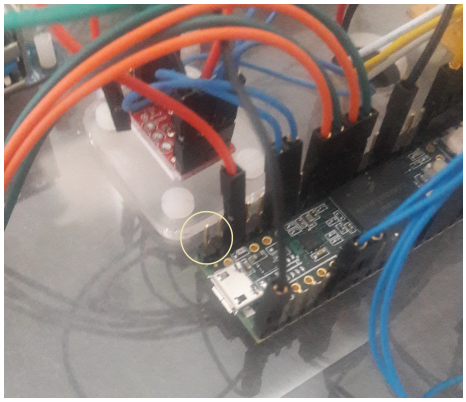
(b) Top later of the robot - servo and camera.



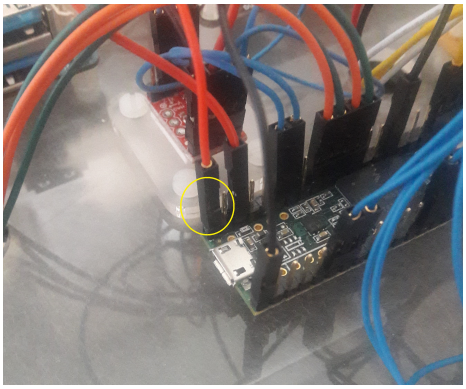
(a) Connecting switch for the low level circuitry. The connector can be fitted onto the pins either way around.



(b) Connecting computer switch and battery wires to the voltage regulator.



(a) Teensy needs to be powered from USB.



(b) Teensy being powered from low level power board.