FAQs

Q1: What types of sensors are allowed, and how many can we use?

A1: You are free to use any type or number of sensors as long as the total cost of the vehicle falls within the budget limit. Please note that WiFi sensors and receivers are not permitted.

Q2: Will there be a marking on the track to follow?

A2: Yes, the track will have a white centerline running throughout and will be covered with black sandpaper (~grit 80) to provide wheel traction. Additionally, a white line perpendicular to the centerline will indicate where the vehicle must unload the cargo.

Q3: Is the vehicle required to pick up the weight?

A3: The challenge does not require the vehicle to load or pick up the weight. The weight could be manually placed on the vehicle. However, the unloading of the cargo at the designated unloading zone must be pre-programmed and automated.

Q4. Does the robot have to be a line follower or it can be any robot to do the job?

A4: There will be markings on the track so that the line follower can detect them. However, you are free to use any other design/sensor to guide the robot up the mountain and do the job. There is NO requirement that the robot has to be a line follower.

Q5. Does the payload have to be manually loaded into the robot or it also has to be automated?

A5: As mentioned above in Q3, the loading can be done manually while the unloading shall be automated.

Q6. Does the robot have to return back to the original position?

A6. That would be awesome. However, there is no such requirement in the problem statement. The requirement is just to deliver the payload successfully at the designated spot on top of the mountain. We will help you out if you want it to return back to the original position. You will get creativity/innovation points for adding extra functionality.

Q7. Can we procure a few items online which are otherwise not available in the Makerspace Lab?

A7. Yes. But keep the bills and make sure that your total project budget (excluding 3d printing material, acrylic sheets, arduino) does not exceed the set project budget limit. There will be severe points deduction for going over-budget. Also, we will verify all bills at the time of evaluation.

Q8. Will there be a final report or presentation?

A8. Yes. You will be asked to (a) prepare a 5 mins video of your robot climbing up the mountain and delivering the cargo and all team members discussing your experience with this project (b) project final report discussing all mechanisms, approaches, bill of materials, learnings, etc, and (c) final live demonstration/evaluation/viva by course faculties.

Q9. What is the approximate volume of the pebbles (to decide the box dimensions)?

A9. You can assume the pebbles to roughly have the same density as that of water for your design and use a factor of safety of 2. This factor of safety will be useful to account for voids that would be present in between the stones.

Q10. Is it necessary to deploy the payload individually or can we drop a box containing the payload?

A10. As per the problem statement, the payload will be loose pebbles. However, you are free to load them into the vehicle as per your liking. At the end, you have to deliver them as loose pebbles.

Q11. Can we borrow/issue the items from Tinkerers lab if they provide them?

A11. For any borrowed items, you have to provide a reference price of the item using standard websites such as Amazon, robu.in, etc. Even though these items would be borrowed, their full price shall be included in the project budget. Exceeding project budget will incur severe penalties.

Q12. If the motors we have are not working properly, can we buy them?

A12. The objective of the project is to meet our deliverables within the allocated budget. If you feel that your motor is damaged or if you need another alternative motor, feel free to buy them but note that these new motors will also be counted towards the project budget.

Q13. How do we decide on the batteries to be bought for the MS101 project?

A13. You should buy only Li-ion/Li-Polymer batteries which are rechargeable batteries. (Do not buy single non-rechargeable 9 V batteries which cannot supply more than 100 mA). Your project requires a total of about 0.6 to 1 A (i.e. 600 to 1000 mA).

Li-ion batteries are available as single cell batteries (i.e. 18650 battery) or a battery pack of 2 or more batteries. The single 18650 battery is a specific rechargeable cylindrical battery commonly used in various electronic devices and applications. The term “18650” represents the battery’s dimensions: 18mm in diameter and 65.0mm in length.

If you are buying single cells, be sure also to buy battery case for holding 3 battery cells for use in the project.

Q14. How do we charge the Lithium ion/Lithium Polymer batteries we bought? What are the precautions to be followed?

A14. The major precautions in charging a Li-ion battery is to prevent over charging and to follow the recommended charging cycle.

Li-ion battery charges are available. You may buy them, but please ensure that it has proper battery management features (with over charge voltage protection).

Another option for charging is to use the MS101 Keithley DC Power Supply. It would take about 1.5 to 2 hours to charge a battery cell or a battery pack. It is important to choose the correct charging voltage and current setting. Any attempt to charge Li-ion batteries at a faster rate (i.e. using charging currents > 1 A) may result in permanent battery damage. For longer life, Li-ion batteries are charged typically to about 80% its capacity through slower charging (i.e. charging currents less than 1 A). Recommended settings are given below. You also refer to the Application Note BU-409: Charging Lithium Ion (https://batteryuniversity.com). This site has several other articles on Li-ion batteries.

a) If you are charging a single Li-ion battery, then set the Power Supply Voltage as 4.0 V and set the current limit to 0.5 A or 0.75 A. With these settings it would take about 2 hours to charge a 3.7 V, 1500 mAh cell. This would charge the single cell to about 80% of its capacity.

b) If you charging a Li-ion battery pack (consisting of three Li-ion cells) with a nominal output of 11.2 V, then set the Power Supply Voltage as 12.0 V and set the current limit to 0.5 A or 0.75. A. This would charge the battery pack in about 2 hours to about 80% of its capacity.

Q15. What is the lowest voltage up to which a Li-ion battery can be discharged?

A15. The lowest voltage (or full discharge) of a Li-ion battery is 3.20 V per cell. Hence if you are using a Li-ion pack consisting of three Li-ion batteries, the full discharge voltage is 3 x 3.20 = 9.60 V. Measuring the open circuit voltage (at rest) gives an idea of the state of charge, with 100 % at 3.70 V and 0% at 3.20 V.

Q16. How do we calculate the total power requirement for our project?

A16. You need to make a detailed calculation. A sample calculation is shown below.

Let us assume that you are using two BO motors, one Arduino board, one motor driver module and two IR sensor modules. Some rough estimates of the current drawn from your Li-ion/Li-P battery pack (of 11.2 V) is shown below.

2 BO motors : 2 x 200 mA = 400 mA

Arduino board : 50 mA

Motor driver card : 100 mA

IR cards : 2 x 20 mA = 40 mA

Total current requirement : 600 mA (approx.)

Q17. How long will our battery pack last if the total current drawn is about 600 mA?

A17. Assuming that you have a fully charged 2000 mAh battery pack (say charged up to 80% capacity), the battery should last up to about 2 hours.

Stage 2 Report Questions

Q1. Progress Update: Begin your report by sharing the progress your team has made so far. Describe what you have accomplished and what you are currently working on. Include any challenges you have faced and how you have addressed them. If there are any questions or concerns that your team still needs to address, mention them in this section.

Q2. Solid Model: Create a Fusion360 solid model of all parts with proper dimensions and assemble them. Upload a zip file consisting of all individual components and the final assembly (similar to ME Lab 5).

Q3. Orthographic Projections: Use the solid model to extract orthographic projections of all the parts that make up your vehicle. These projections should clearly show all the critical dimensions, such as length, width, height, and angles. Label each part with its name and dimensions. Compile a single pdf of all these components for upload.

Q4. Explanation of Each Part: Along with each orthographic projection, provide a brief explanation of the purpose of each part and how it will contribute to the overall functionality of your vehicle. Discuss any design considerations that your team has made for each part.

Q5: 3dPrinting/LaserCutting Files: Using the tools provided in ME lab 7, create GCode (for 3d printing) and UTF (for laser cutting) files for all needed components. Upload these files as two separate zip folders, one for 3D printing, and second for laser cutting.

Q6. Bill of Materials: Include a bill of materials for your vehicle. This should list all the materials and components that you will need to build your vehicle. Include the quantity and cost of each item. Fill up the 3dprinting and laserCutting job sheet (provided here along with this milestone) and upload it.