CONCEPT MAP OF UNIT

Students will build an arm / gripper onto an already built chassis and attempt to improve the design. They will then describe the physics involved (torque, angle, etc.) in being able to pick up an object and then depositing it into a cup.

TOPIC:	STEM 1: Robotics
TEACHER	Debbie Grothaus
GRADE	9th grade Physics

KEY LEARNING(S)

Following directions from a manual and then modifying the design based on the specifications of the task. State the physics behind each step of the task and how their design follows the laws of physics.

UNIT ESSENTIAL QUESTIONS

What modifications can done to the robot in order to accommodate the given task of picking up a small object and placing it in a cup?

What physics laws are being demonstrated in the task?

OPTIONAL INSTRUCTIONAL TOOLS

Tetrix Builders Guide and included DVD.

Tetrix robot kit with the chassis already built.

Physics text book for reference.

CONCEPT

Creating a robotic arm and gripper on a pre-built chassis,
Use of appropriate structural components, to create an arm and gripper with adequate room for all drive train, and electronic sub-systems.

LESSON ESSENTIAL QUESTIONS

How do you build the arm / gripper component on the tetrix pre-built chassis based from the original directions?

VOCABULARY

Structural component

CONCEPT

The drive train consists of the motor, any possible gearing, chains & sprockets, and associated axles, bearings, hubs and locking collars.

LESSON ESSENTIAL QUESTIONS

How could you modify and design the arm / gripper system to be able to pick up a small object and drop it into a cup?
How will you plan for the range of motion of the arm / gripper system

VOCABULARY

Drive motor, Motor connector
Motor mount, Output shaft
Flat part of shaft, Axle
Motor hub, Axle hub
Bronze bushing or bearing
Gear, sprocket and chain, master link

CONCEPT

A basic robot platform includes the electronics to operate the basic drive train. In the case of teleoperated robotics, this includes batteries, receiver, motor controller, switches and wiring.

LESSON ESSENTIAL QUESTIONS

Where will you locate the drive motors and other drive train components?
How will you transfer the motors' power to the arm and gripper?

VOCABULARY

CONCEPT

There are several physics principles being used in the process of grabbing an object and depositing it into a cup, including Newton's laws, electricity, torque, work, circular motion, etc.

LESSON ESSENTIAL QUESTIONS

What are the physics concepts being used in the process of picking up an object and transferring it to a cup?

VOCABULARY

Newton's Laws
Force, momentum
Electricity
Torque
Work / mechanical advantage
Circular motion / range of motion

ADDITIONAL INFORMATION

Extension: "How can the arm and gripper be adapted for use in a broader range of purposes?" Students could modify the design as needed.

CONCEPT MAP OF UNIT

This 9-week unit plan will enable students to demonstrate understanding of the creation and the operation of robots. This includes becoming familiar with the basic parts needed to build the chassis and drive train as well as the arm & gripper. Basic knowledge on wiring and making the right connections from transmitter to receiver to make the robot perform the desired motion will be part of this unit.

TOPIC: MI- ROBOT	Science and Technology
TEACHER	Mignon Penalosa
GRADE	8th grade

KEY LEARNING(S)	UNIT ESSENTIAL QUESTIONS	OPTIONAL INSTRUCTIONAL TOOLS
Building the chassis platform and attaching the motors to create the drive train. Designing and assembly of the arm & gripper.	What is the best design for a stable chassis? How will you manipulate the assembly of the arm & the gripper so that the robot performs the desired motion?	Tetrix Robotic Kit

CONCEPT	CONCEPT	CONCEPT	CONCEPT
Metals make strong and stable chassis because they are sturdier than other materials. A square shaped chassis makes it more stable and the 7/64" hex key is needed for the assembly.	The drive train consist of 2 motor assembly (drive motor, motor mount, 2 x 3" wheel, motor shaft hub, ½" screws) attached to the chassis. The arm and the gripper is made of the appropriate metal pieces, screws, kep nuts, and servo motors that control the movement of both the arm and the gripper. The wires to these assemblies are all connected to the robots receiver.	When the wires from the motors and servos are connected to the correct terminals, the robot will carry out the desired motion: forward, reverse, right turn, left turn, grab the object and lift it.	The challenge is to design the most stable, and best performing robot that can carry out all the tasks required.
LESSON ESSENTIAL QUESTIONS	**LESSON ESSENTIAL QUESTIONS**	**LESSON ESSENTIAL QUESTIONS**	**LESSON ESSENTIAL QUESTIONS**
Why are robots built out of metal pieces better than plastic ones? What shape of the chassis makes it most stable?	Why do we use the drive motors for the wheels and servo motors for the arm and the gripper? Can we switch the motors? Why or why not?	Explain what happens if motors and servos are not connected to the correct terminals on the receiver?	Why is it important to innovate when it comes to designing the robot?
VOCABULARY	**VOCABULARY**	**VOCABULARY**	**VOCABULARY**
Chassis Hex key	Drive motor, Motor mount Motor shaft hub, Screws and kep nuts Servo motors, Hubs Servo collar, Bushing, Axles Spacers	Receiver Transmitter Terminals/channels	Rotation Stable

ADDITIONAL INFORMATION

Vexrobotics.com

CONCEPT MAP OF UNIT

This unit will start with the introduction of robotics, their importance to everyday life and how they are used in industry. It will go through the familiarization of different parts and materials needed and explore the fundamentals of robotics. The main output will be the creation of a basic robot chassis, followed by the installation of drive train components and wheels, then wiring of the teleoperated control system.

TOPIC: MY FIRST ROBOTIC PLATFORM	STEM 1: Robotics
TEACHER	Ronelie D. Asuncion
GRADE	9

KEY LEARNING(S)	UNIT ESSENTIAL QUESTIONS	OPTIONAL INSTRUCTIONAL TOOLS
Creating a basic robotic platform, complete with well designed chassis, drive train, and correctly installed electronics	What makes a simple but effective robotic platform? What needs to be considered when designing the platform?	Tetrix Builders Guide and included DVD.

CONCEPT	CONCEPT	CONCEPT
Building the basic chassis of the Ranger Bot by observing the safe building practices and proper usage of required hand- tools.	The drive train consists of the motor, any possible gearing, chains & sprockets, and associated axles, bearings, hubs and locking collars.	A basic robot platform includes the electronics to operate the basic drive train. In the case of teleoperated robotics, this includes batteries, receiver, motor controller, switches and wiring.
LESSON ESSENTIAL QUESTIONS	**LESSON ESSENTIAL QUESTIONS**	**LESSON ESSENTIAL QUESTIONS**
How can you design a stable chassis with the appropriate structural components?	What is the proper positioning of the drive motors and other drive train components to have a well-functioning robotic platform?	How does the Ranger Bot perform basic movements? How do the basic components be connected to function properly? Why are neat, organized wiring and correctly mounted components important?
VOCABULARY	**VOCABULARY**	**VOCABULARY**
Channel Flat building plate Kep nut “U” channel Structural component Hex-head cap screw	Drive motor, Motor connector, Motor mount Output shaft, Flat part of shaft, Axle Motor hub, Axle hub, Locking (or set) collar Bronze bushing or bearing, Nylon spacer Drive wheel assembly	Receiver Motor controller Slide switch Rocker switch 12 volt battery 4.8 volt battery

ADDITIONAL INFORMATION

This unit deals with students building and understanding a basic “robotic platform.” It includes designing and constructing the chassis, designing and installing the drive train, and correctly utilizing the electronic control subsystem crucial for teleoperated robotics.

A second unit can deal with the creation of the manipulator using servo motors and other components.

Assessment will consist of vocabulary and wiring tests, the actual work done, and work habits (often called “career readiness.”)

CONCEPT MAP OF UNIT

This unit will help students discover how to create teleoperated (remote controlled) robot designs. Students will first build a chassis, then install the drive train components and wheels, and wire the teleoperated control system. Students will teleoperate their robots, learning motor control, as a final assessment of this basic beginning unit. Students will demonstrate creativity and ingenuity, increase problem-solving skills, confidence and enthusiasm for the fields of engineering and robotics.

TOPIC: CREATING A BASIC PLATFORM	STEM 1: Robotics
TEACHER	Lisa Sipp
GRADE	7th Grade

KEY LEARNING(S)

Students learn to create a basic robotic platform, including chassis, drive train, and correctly wired electronics.

UNIT ESSENTIAL QUESTIONS

What makes a simple but effective robotic platform?

What needs to be considered when designing the platform?

OPTIONAL INSTRUCTIONAL TOOLS

Tetrix Builders Guide and included DVD.

CONCEPT

Use fundamental components to create a chassis that will appropriately house the drive train and electronic sub-systems needed to create a well-functioning robotic platform.

CONCEPT

The drive train consists of motors, gears, chains and sprockets, and associated axles, bearings, hubs and locking collars.

CONCEPT

A basic robot platform includes the electronics to operate the basic drive train. Teleoperated robots utilize batteries, a receiver, a motor controller, switches and wiring.

LESSON ESSENTIAL QUESTIONS

What function/s do you want your robot to accomplish? What factors need to be considered in your design? *How can you design a chassis to accommodate all the sub systems of the robotic platform? How will you plan for proper weight distribution?* What is the best way to use the tools and parts in the building process?

LESSON ESSENTIAL QUESTIONS

Where will you place the drive motors and other drive train components? How will the traction components receive power from the motors?

LESSON ESSENTIAL QUESTIONS

What basic components make up the electronics sub system and what is each component's function? What kind of care should be taken with the electronic components? Why are neat, organized wiring and correctly mounted components important?

VOCABULARY

Teleoperated
Chassis
"U" channel
Structural component
Hex-head cap screw

VOCABULARY

Drive motor, Motor connector, Motor mount
Output shaft. Flat part of shaft, Axle
Motor hub, Axle hub, Locking (or set) collar
Bronze bushing or bearing, Nylon spacer
Gear, sprocket and chain, master link

VOCABULARY

R/C Transmitter, Receiver
Motor controller, Slide switch
Rocker switch, 12 volt battery
4.8 volt battery

ADDITIONAL INFORMATION

The next unit introduces the next component to add to the robot by creating a manipulator, using servo motors and other components.

Assessment will consist of vocabulary and wiring tests, the actual work done, demonstration of teleoperation, and work habits (often called "career readiness.")