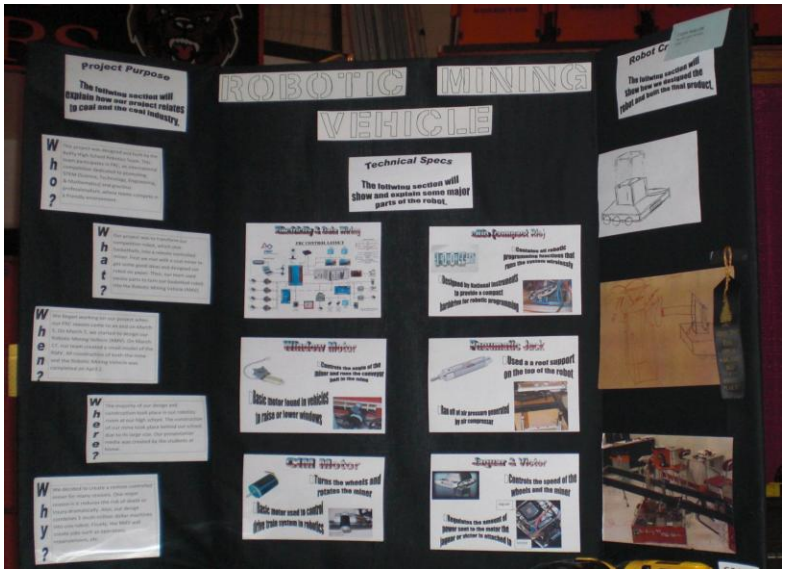
Robotic Mining Vehicle

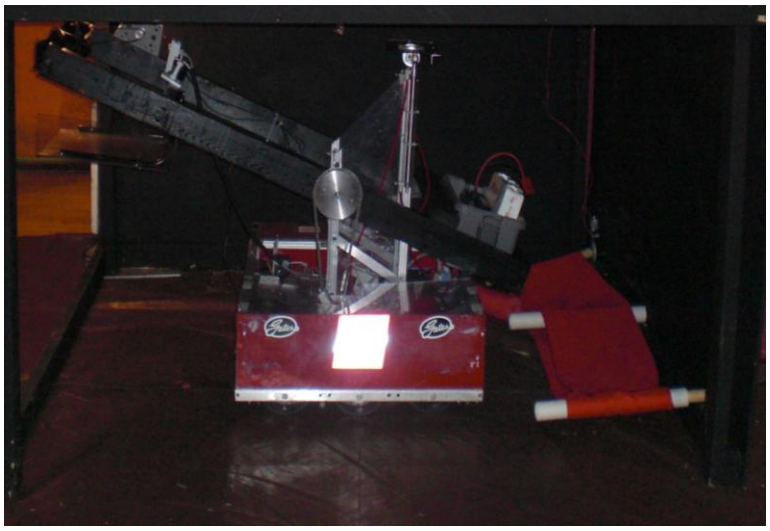
For the first time in the history of the CEDAR Regional Coal Fair program students at Belfry High School created a project in the Technology/Multimedia category that explored Artificial Intelligence; specifically “robotics, hydraulics or pneumatics” as they relate to coal.

During the school year, this team of students participated in an international competition known as FRC, or First Robotics Competition. After the FRC season ended, two of their teachers, Mr. Mendoza and Dr. Haridas, met with the students to discuss taking what they had learned in the robotics competition and applying it to a Coal Fair project.

Mr. Mendoza brought in pictures of mining equipment to help generate ideas. With recent advancements in the field of robotics, the students reasoned that the coal mining industry would be safer and could dramatically reduce the chances of death or serious injury by using remote-controlled robotic equipment to mine coal. The team met for four days straight to design what would become their first RMV, or Robotic Mining Vehicle. The unit featured a continuous miner and was equipped with its own roof support system all controlled by a compact hard drive.

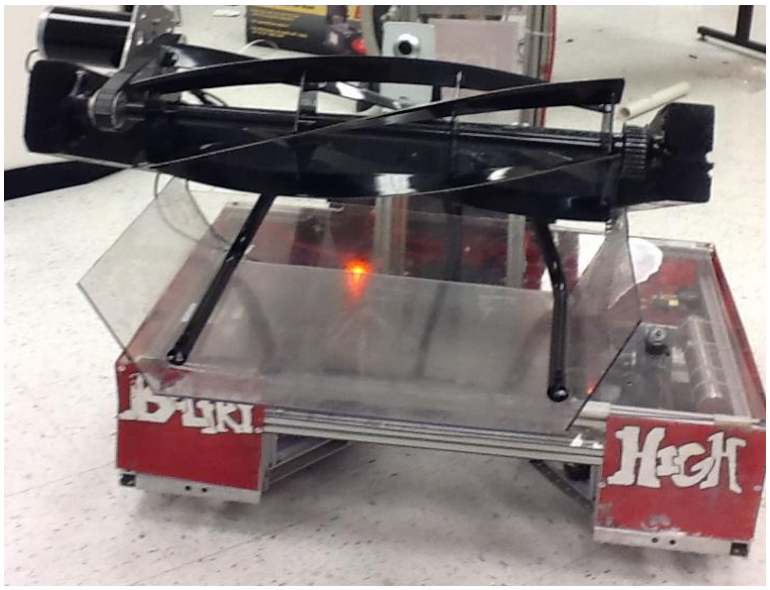


While half of the team began planning and building a model underground coal mine, the other half started constructing the robot. Working after school every afternoon for three weeks, sometimes as late as 8 o'clock at night, assembly of the project began to take shape.



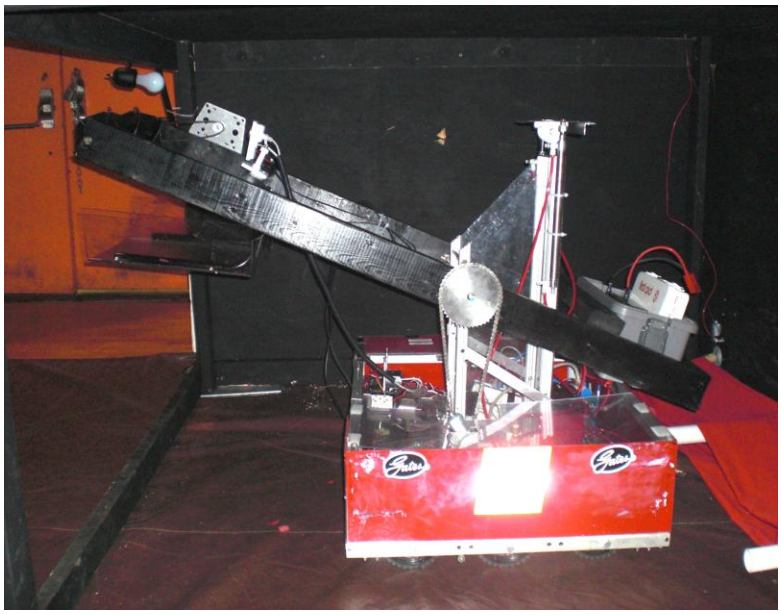
The base of the unit the team used in the international competition was repurposed, and most of the wiring redone. The core component of the robot was a cRio. This compact hard drive was developed by National Instruments and stored all robot code to run the unit. The robot code was programmed by one of the team members. The robot was controlled by setting up a secure wireless connection between the robot and a mini-laptop and was operated from a drive station using joysticks.

The decision was made to equip the mining arm with a push lawn motor blade to represent a continuous miner.

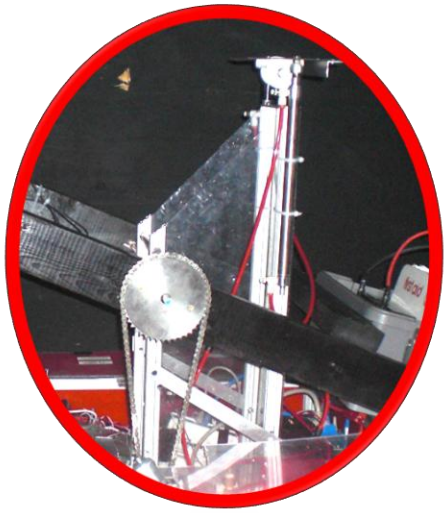


The main motor used was a CIM motor. This standard motor powered the continuous miner and also the wheels for driving the unit within the mine. A camera, also mounted on the mining arm, allowed the operator to see where and how to move the RMV.

To control the speed of the unit a Jaguar-a speed controller was connected from the power supply into the CIM. Joysticks on the drive station controlled the amount of electricity sent to the motor.



The roof support feature was powered by a pneumatic system. The system consisted of an air compressor attached on the base, and solenoids, pneumatic tubing, an air tank, and pneumatic jacks that connected the compressor to the air jacks. The compressor pumped air through the pneumatic lines into the air tank where it could be stored for use. The air was held in the tank until a button on the joysticks was pushed, sending a wireless signal to the robot. The robot recognized the signal and told the solenoid to open allowing the air to flow to the jacks pushing up the roof support. When the unit was ready to be repositioned or moved to the next location, the operator pushed another button sending a signal to tell the robot to bleed the pressure out of the system allowing the roof support to slowly fall back into its resting position.



This allowed the RMV operator to easily control the up and down movement of the roof support and provided the strength required to hold the roof up. In a real life situation, hydraulics would take the place of the pneumatic system for greater strength and failure resistance.

The model underground coal mine allowed them to demonstrate all the features of the robotic mining vehicle in action.