



FIRST Robotics

Lego League Challenge

Brown County Mentors' Guide

Thank you for volunteering to be a mentor on a children's Lego Challenge team. This guide is intended to help you navigate working with your fourth thru eighth grade Lego League Challenge team. FIRST is about inspiring children to be science and technology leaders and innovators. Our job as a mentor is to allow the kids to experience the engineering process utilizing math, science, trial/error, and research while building teamwork skills in an exciting, fun, group atmosphere. The mentor helps foster innovation, self-confidence, and communication/ leadership skills. The first goal should be making sure your team is having fun, learning and hoping to return to the program the following year. Celebrate all successes and acknowledge and learn from failures. There is a competition within this developing process, but it should not be the main driver of the growth unless the student team agrees it to be so.

Corporate Background History: FIRST stands for “For Inspiration and Recognition of Science and Technology”. Dean Kamen who is an inventor, entrepreneur, and advocate of science and technology started FIRST over 30 years ago. Mr. Kamen has many robotic advancements in the medical field which help out so many different people. His vision is “To transform our culture by creating a world where science and technology are celebrated and where young people dream of becoming science and technology leaders. FIRST’s core values represent his cultural growth thru the several levels of the robotic program levels.

Brown County History: FIRST is a group of 4 programs in the Brown County area including: **Lego League Explore** (K-4), **Lego League Challenge** (4-8), **Tech Challenge** (7-10), and **Robotics Competition**. Although held at several schools, FIRST is not a part of the school district system. It is rather a non-profit group of volunteers who feel it is important to our community environment to support the STEM community and introduce the excitement of science, math, engineering and technology fields to children early on. **Lego League Challenge** started at Foxview Intermediate School and Leonardo da Vinci School in 2021. Participants were from within these schools as well as a few students from nearby schools who were interested in LEGO robotics. ANY student within the grades listed, from any school is welcome to join the local groups. We are constantly trying to continuing our outreach program to the surrounding community schools in a sustainable manor. Without mentors like you this would not be possible.

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CORE VALUES

FUN – We enjoy and celebrate what we do!

INCLUSION – We respect each other and embrace our differences.

DISCOVERY – We explore new skills and ideas.

GRACIOUS PROFESSIONALISM – We encourage high-quality work, emphasize the value of others, and respect individuals and others in the community.

IMPACT – We apply what we learn to improve our world.

INNOVATION – We use creativity and persistence to solve problems.

TEAMWORK – We are stronger when we work together.

Students are expected to know, understand and demonstrate all of the above core values at competition and during practices. At competition, judges may be walking around observing students outside of their presentation times or robot competitions. One of FIRST's many statements is "This is not a robot" which has deep meaning the more you get involved in your teams growth.

One additional term you will hear is COOPERTITION. FIRST is about displaying unqualified kindness and respect in the face of fierce competition. It is about helping others as well as your own group no matter what. FIRST is about recognizing everyone's contribution within the many different teams and local communities. It is about great enthusiasm that will naturally pass onto others as these values are developed.

WAYS YOU CAN PROVIDE MENTORING SUPPORT

It is understood that many of our mentors do not have engineering, mathematical, science, or robotic programming skill sets. Please do not let this limit you to the opportunities you may have to be an impact of getting the students engaged and excited about the world of STEM activities.

Below are a few ideas of areas you can help your group out IF you do not have these skills.

- Help your teams with decision making processes
 - Make sure everyone can openly express their ideas
 - Make sure all criticism is constructive.
 - Make sure that WILD ideas are as acknowledged. Sometimes wild ideas explored further turn into pretty creative solutions
 - Provide methods that may help the students finalize a solution
 - Remind students of a KISS design solutions. “Keep it simple silly”
- Help students understand the validity of various research options
 - Most students will say they used GOOGLE to research options. They will probably not have had classroom discussions yet as to what websites are valid research sources and why
- Help students learn and demonstrate core values
- Help students process frustrations and failures so they learn from their experience and turn that failure into something positive.
- Provide life experiences to the students as they begin their exploration of their robots and research presentations
- Help your group recognize and process individual’s differences. FIRST is a program that allows an outlet or a way to participate for individuals whom may have special needs, social anxieties or awkwardness, shyness, or those who typically stand out from others in their class due to excelling in math, science or hands on activities. All of these individual specialties can grow into growth opportunities for the individuals and the group.
- Help the students determine how they are going to present their robots, presentations, and group to the local community. For many students, they have never presented before Infront of anyone. Their own experiences are probably limited to their classroom experiences.
- Help document the learning process – Take photos, help the kids take notes about successes and failures, help the kids have fun.

PARENT/TEAM COMMUNICATION

At the beginning of the season, the program lead will request contact information from each student/parent. Your student teams will then be entered into a database. Each group leader may get contacts for their specific child's group. If you need this, please request this from your program lead.

Use care when sharing others' contact information from your team unless you have prior approval. When sending emails, use the 'bcc' lines to send out group emails to those who have not given approval to share their emails with others.

Parents appreciate an update to what their students have been up each week OR at least every other week. Emails are a great way to share simple photos of the teams robots, individuals tasks they are working on, and homework assignments. There is a lot of information to pull together between the students' robot construction/programming and their research assignment. Homework is a great way to help those parents who can't mentor due to time constraints become involved in your group.

FACEBOOK:

- **Brown County FIRST Robotics**
- **Lakeshore First Robotics** – Manitowoc's FIRST Robotics group which was are partnered with to help our growth and development
- **FIRST Robotics**

INITIAL MEETINGS

Kick-off meeting

- The kickoff meeting will be to discuss THIS year's challenge. Kids will be meeting as a large assembly, not individual groups. This is intended for all students to build relationships with everyone getting involved in the FLL program. The following items will be presented
 - The robot challenge board (typically a video)
 - The project presentation topic
 - Background to this presentation topic (how does this topic affect the world)
 - The challenge board build kits (there are several Lego models that must be constructed to be Velcro attached to the challenge mat)
 - A simplified signup form for the group will be passed around. This will request the following information
 - Student's name
 - Student's current grade
 - Parental contact
 - Name, Email, Phone number
 - Permission for the smaller group mentors to be able to contact the parents and share group information with each other freely
 - Request for the parents to be a mentor of a group
 - If parents are not able to be a mentor of a team, it is suggested they offer help out on a rotating basis with the group.
 - A form will then be passed to parents requesting further information about your child. This should be returned at the next meeting and is used to help the mentors best mentor each child, or be aware of specific needs or interests.
- After – children will be assigned challenge mat build kits. Each parent should help their child out with the challenge build model. It is important the models are built per the instructions as they will be challenge pieces each robot tackles for the rest of the year.

Second meeting

- Students will be separated into groups of 6-8 kids. Friends may stick together but sometimes it is better for the team if friends are separated so there are contacts outside the group if the team needs help.
- Mentors will be assigned to the group (typically it is parental based unless a parent requests to not be assigned to their child's group)

INITIAL MEETINGS continued.....

Second meeting continued.....

- Mentors should do a team meeting to get to know your team (icebreaker type activity). Topics could include:
 - Introduction of mentors
 - What does the mentor know about robotics or previous mentoring experience?
 - What does the mentor do for a living? Explain this job to the kids
 - Does the mentor have children of their own?
 - Introduction of team members
 - Name, Grade, school
 - What brought the member to FLL?
 - Is this the member's first year in FLL?
 - Does the member have experience with Legos?
 - Does the member have experience with Lego technics?
 - Has the member done any form of programing?
 - Does the member like gaming or computers and why?
 - Does the member like ART or Drawing?
 - Does the member like researching?
 - Has the member done any presentations in the past?
 - What is the members favorite hobby?
- Finish any challenge models assigned to the team members as a group
- Start a discussion on team name/ logo.
 - Many times, this is a great homework assignment and can be one of the first things voted upon in the third/fourth meeting. Each student should vote for someone else's idea. It is important to allow each student to express they think their name fits the group and will best represent the team.
 - Sometimes this is a great way to start discussions about professionalism as some team names are given to be funny by kids rather than being something the team wishes to be proud of later.
- Start a build of a base robot that can be programed. See the robot section below.

Some mentors will be requested to help assemble the challenge board by the lead program mentor. The challenge pieces must be secured to the board using Velcro squares which must be carefully placed onto the mat. The challenge piece is carefully outlined on the board to indicate how it needs to be placed so the robots can be programmed consistently to reach the challenge. By mid-meeting, it would be nice to have one board assembled so groups can come around the board with the lead mentor to discuss this year's challenge and how each piece works.

TYPICAL MEETINGS

- Meetings are typically 2 hours long and twice per week. Ideal group sizes are from 6-8 kids per group. This allows the kids to be split up into 20-30-minute-long task-oriented groups for the challenge with a rotating task. Each student should be involved in the below tasks at some time. Some will prefer one task over the other but each must try.
- Tasks are:
 - Robot building, planning and design – Includes attachments and jigs
 - Robot programming
 - Typically, 1 challenge is tackled per two-person team until it is figured out. This does include some discussion between the design team and the programming team as attachments may need to be developed. It is also a good way for this smaller group to transition into the building and planning portion.
 - Project Research and Project Development
 - Project and Robot documentation
- Teams as a whole should be involved in decision making for the team but the group can then be split up to tackle the decisions made
- Students should be helping with setup and cleanup efforts. No one should be leaving until the space is restored to a better than received condition.
- Robot Challenge Board:
 - Strategies to approach the challenge board tasks
 - What challenge task can the student tackle easily?
 - Which challenge has the most points possible vs challenge difficulty level vs accuracy
 - Which challenge task could be combined with another task, maintain accuracy and still return home?
 - Which challenges utilize the same attachments?
 - How many of our solved challenges fit within the total 2:30 timeline
 - For rookie teams, it is easiest if each team of two-three students approach one task apiece. This allows the students to understand programming, design of the bot and add-on attachment pieces easily. It also allows for the table to be subdivided up during the meeting schedules.
 - The robot accuracy is best on the actual practice field boards. Initial learning is fine on the mats placed on the floor or tables assuming the joints in the tables are addressed. 1/16" gaps and unevenness, tend to throw the accuracy of the small wheels off.

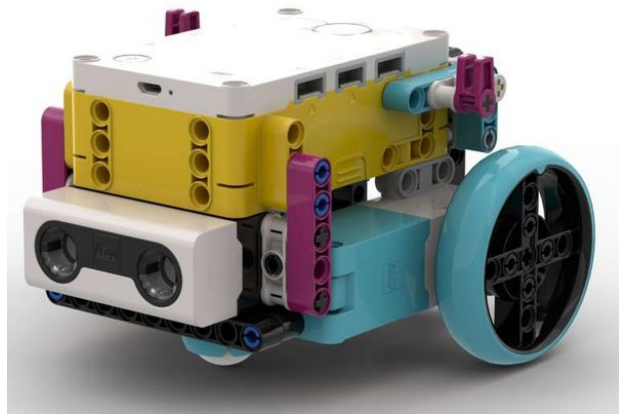
ROBOT CONSTRUCTION

- **BASE BOT DESIGN:** Each group of students starts off the event with two Spike Prime Lego robot kits. This allows the group to explore various base design options for the robot with testing methods. By the 5th meeting, a single base robot design should be determined and the other bot constructed **exactly** to match the chosen design. This secondary matching robot allows for double programming efforts closer to competition and serves as a backup robot incase something in the first one becomes faulty. *Only one robot and no tablets may be brought up to the challenge table for use during the competition.*
 - There are base robot designs available online. The advanced driving base can be found at <https://education.lego.com/en-us/lessons/prime-competition-ready/assembling-an-advanced-driving-base#lesson-plan>
 - This is not a required design and the Innovative method is to allow the children to experience their own design, but if your group is struggling, this is a starting point.
 - Many other add-on features can be found at <https://education.lego.com/en-us/product-resources/spike-prime/downloads/building-instructions>
 - This is a source for:
 - A simpler driving base option
 - Sensors and simple arm designs etc.
 - Lesson Plans for robot building can also be found at <https://education.lego.com/en-us/lessons/prim-competition-ready>
- **ROBOT BASICS**
 - The robot may only have (4) motors, color sensors, touch sensors, or ultrasonic sensors and the spike block
 - Motors may be utilized at the teams discretion. Small or large motors may be the drive devices or the arms devices
 - Sensors are very important in autonomous driving in higher up robotics programs and therefore are highly encouraged by judges to be explored on the Lego end of the design. They can be temperamental in the robot programming. Many rookie teams may experiment with them but end up without usage

ROBOT CONSTRUCTION continued.....

- **ROBOT BASICS CONTINUED.....**

- The robot must be constructed using only Lego supplied parts
 - Any LEGO produced parts are allowed from any year or any kit. Teams will not be reimbursed for purchasing additional pieces not provided in their FIRST challenge kits.
- The robot has a limiting height, length and width set by THIS year's challenge parameters. Typically, it is a max of 12" tall and a max length of 12" long but some years due to the challenges these change
 - The robot **MUST** fit within the starting area on the challenge mat with all jigs and add on attachments
- Robot Base
 - Rookie teams –
 - Start out with a very basic, compact, sturdy base. Unstable robots will not be repeatable no matter how good the programming, if the robot has flex, it will have problems
 - Build compact bots so they can more easily maneuver the field. Students tend to build large bots.
 - Typically, steering is done by operating each drive motor therefore you need two drive motors and at least one front caster wheel (a ball in cup design) (this is known as the tri-pod bot)



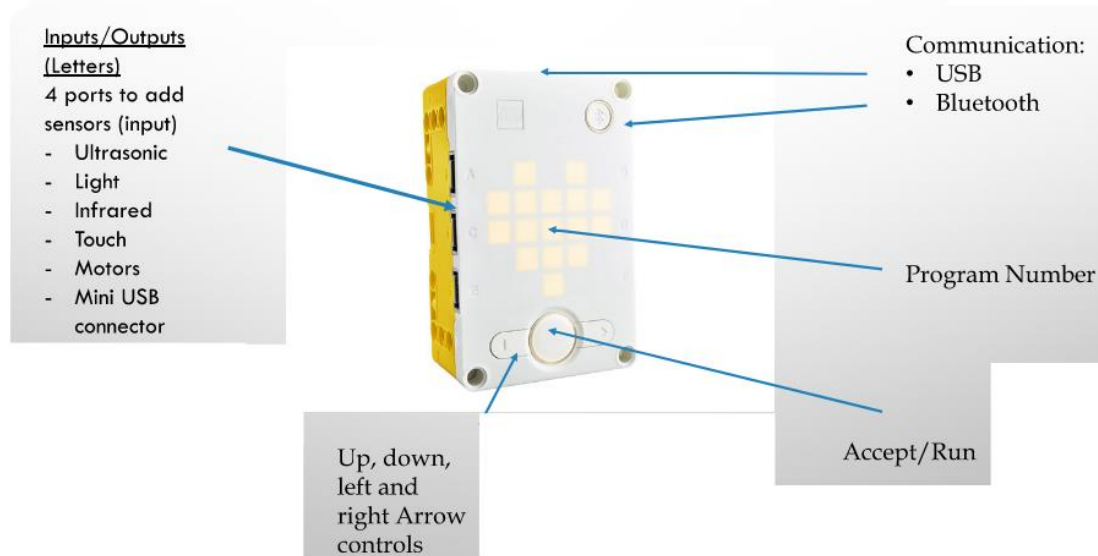
- More advance bases can include
 - Sensors for touch, color (used to track lines on the field – closer to the ground the more accurate), or Ultrasonic sensors (see in the bot above on the front)
 - Tire guards or fenders (keeps your tires from hooking on challenge pieces)
 - Two or more casters for support)

ROBOT CONSTRUCTION continued.....

- **ROBOT BASICS CONTINUED.....**

- Spike Prime Brick – Turn on/off and other controls
 - To turn ON the robot, Press the round button on the robot block once, wait till all the lights flash on the robot
 - To turn OFF the robot, Press and hold the round button on the robot block until the lights flash and then turn off

THE SPIKE PRIME BRICK AT A GLANCE



-
- **Downloading programs to your bot**

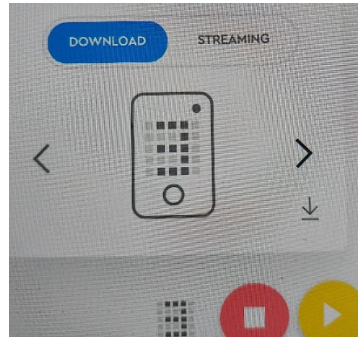
- Downloading Programs to your Robot (required for competition) and running the programs on the bot without the tablet
 - On your tablet, click the button in the lower right hand corner and set your program to a number (you can program up to 19 programs in your bot).



- - While on this screen, make sure the “Download is highlighted in blue” (see image below)

ROBOT CONSTRUCTION continued.....

- **Downloading programs to your bot** continued.....
 - On this same screen, click the underlined down arrow to push this up to your bot



- You can now use the arrow keys on your robotic block to access the number you just programmed. To run the program, press the startup button once (do not hold down)
- **JIGS**
 - Jigs are an important tool utilized to make sure the robot starts from the exact same position on the starting home position each time the program order is run. Many students will try to utilize the lines on the challenge map to locate their robot, but under pressure and multiple programs, students may be on the wrong side of the line or the wrong gray line when they start. Jigs must be located in the home starting position on the challenge mat and cannot extend into the home storage space

ROBOT CONSTRUCTION continued.....

- **Robot Tooling/ Add-on accessories**
 - Add on pieces to your base bot are what get the challenge pieces accomplished They may be simple bulldozer type pieces, lifting assemblies, swinging or flipping assemblies, catch buckets, claws etc. Review each challenge piece and evaluate what the FINAL outcome is supposed to be for each challenge item. Sometimes the tool Lego provides on the challenge piece is not necessarily the way to approach a challenge to end with the same result. Many times a simple pushing mechanism or a simple claw is all that is needed to accomplish a task
 - Mentors can bring students to the board to see what the challenge involves and then ask them “what things in the real world have you seen or done to accomplish something similar?” Good examples are: Forklifts, excavation equipment, parent’s tools, but don’t forget kids experiences with video games or arcade games as well.
 - Initial 3-4 add-on attachments and two different base robots
 - Each programming team will probably have their own add-on attachment to the bot to accomplish their task. This may be on two different constructed robot bases. After 3-4 add-on attachments have been created have a discussion with the team about similarities. See if any of these can be combined into one design AND can be used on a single design base bot.
 - If the add-on attachments utilize an added-on motor, is the motor attached securely and in the same manor for ALL attachments? It is easier if the motor remains fixed and solid on the robot while gears or levers are used to make the attachments work.
 - Quick Attachment
 - Have the students think about quick and accurate attachments – axels and pins can be used for alignment without hard mounts. It is easy to pull a pin or rod to make something add-on or detach.
 - Students should build their own robots. Mentors help by asking how teams could improve the piece
 - Can you make that with fewer blocks?
 - Can you make something to brace it?
 - Do you want to put some attachment points on there?
 - Where is the sensor going to attach?
 - Is there a way to quickly attach or remove this from the main robot base?
 - Can this attachment be used to help any other tasks?
 - When using gears – do the gears strip over themselves or max out under pressure?

ROBOT CONSTRUCTION continued.....

- **UNDERSTANDING VARIOUS PARTS**

- LEGO Technics connection pins come with Friction Pins and non-friction pins. Understanding this, will greatly improve or impede your motor capabilities. Look for the Friction Ridges when determining if you want something to freely move or have drag







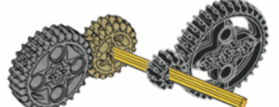
- **FRICTION PIN with Ridges** (color is kit dependent)



- **NON FRICTION PIN** (no ridges)



- **LEGO Technics Gear Ratio**

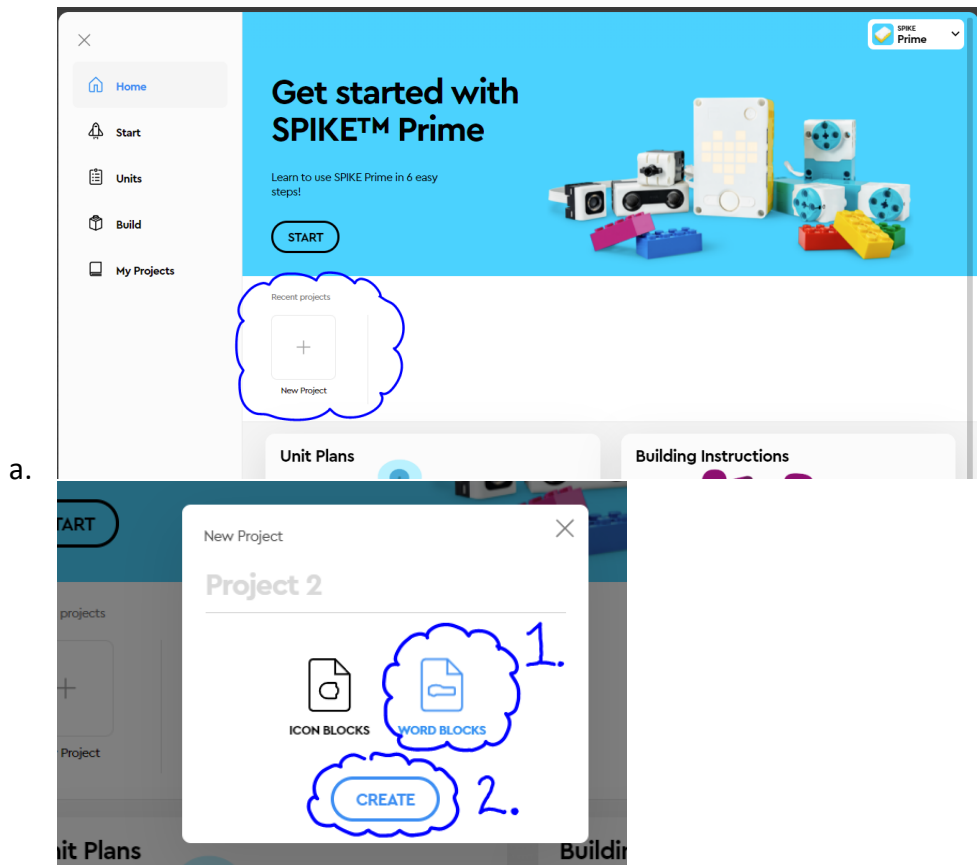
GEARS			
 12-tooth gear  20-tooth gear  28-tooth gear  36-tooth gear	Gearing Up <i>More power/torque, slower speed</i> 	Gearing Down <i>Faster speed, less power/torque</i> 	Gear Trains Combine sequences of gears together 
	12:36 → 1:3 ratio <i>Input turns 3 times for output to turn 1</i>	28:20 → 7:5 ratio <i>Input turns 5 times while output turns 7</i>	28:20 x 1:1 (axle) x 12:36 → 7/5 x 1/1 x 12/36 = 84/180 or 7:15 ratio <i>Input turns 15 times while output turns 7</i>

PROGRAMING HELP

Robot programing is completed thru “Spike Prime”. Each student is encouraged to try programing once even though it may not be there thing. Make sure your tablets are named per your group. A sticky note on the back of the tablet cover with your teams name on it will help easily identify your tablet. You will receive two tablets. Label them with your team’s name and then a 1 and 2

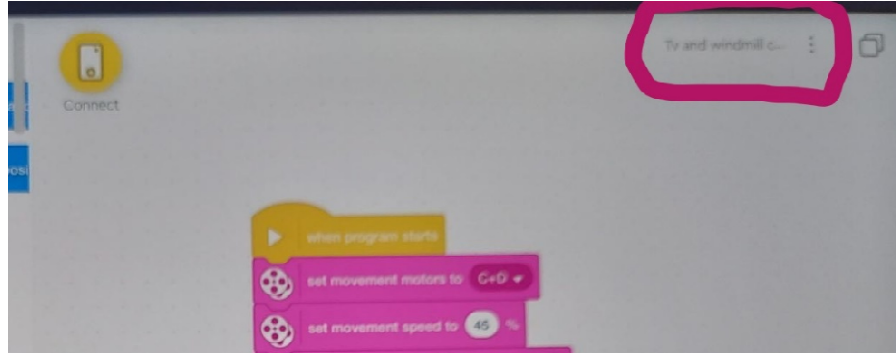
See the appendix at the end of this manual for a list of spike prime guides provided by PrimeLessons.org

1. Start the SPIKE APP, Select “Spike Prime”
2. To start a new program (recommended for EACH team member), go to the home page on the spike prime APP on your supplied tablet and select “NEW PROJECT”, then select “WORD Blocks”



3. Rename your program – suggestion is the challenge being tackled and the kids’ names. Document v1 or v2 if they are playing with different versions so you know which is the most accurate

- a. Click the Ellipsis and select “Rename”

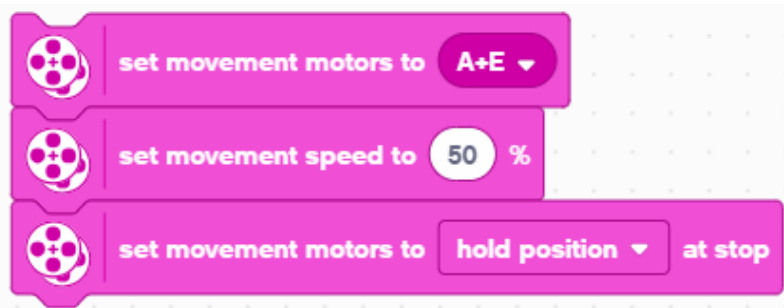


- b.

PROGRAMING HELP continued.....

To start your program – drag programming blocks from the menu area into the programming area in order. You can separate lines and practice parts by moving sections to the right. ONLY the portion on the left side of the programming will run at one time. Use the play button on the tab plus the STOP button on the tablet to direct programs to your bot with the tablet.

1. Set your movement motors and your movement speed – The robot is most accurate at 50% speed to start but may need to be slowed at turns or sped up when accuracy is not necessary

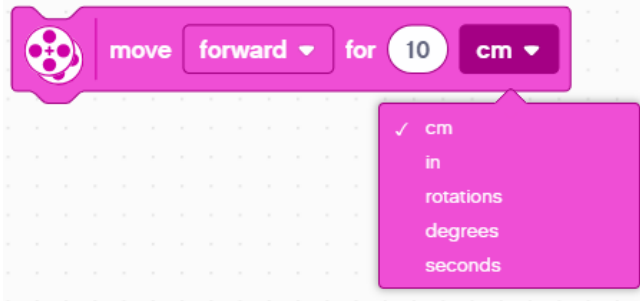


- a.
- b. Letter designations correspond to where your motors are plugged into your spike prime block. Each part has a letter designation
- c. The last line determines what your robot does at the end of a move block (Brake, Hold position, or float). To access this block you will need to go “more movement blocks” from block extensions at the bottom of the tablet. You will need to enable each additional section of controls each time you wish to access them.
 - i. BREAK – After move, bring motors to a hard stop
 - ii. HOLD POSITION – After move, bring motors to a hard stop and use motor power to counter any further movement until the motor is used again. You will not be able to move the motor by hand
 - iii. FLOAT – After move, allow motors to move due to momentum
 - iv. In general – USE BRAKE

PROGRAMING HELP continued.....

2. Movements

- a. DISTANCE MOVES - Default move is set to centimeters (you can use inches but additional conversion is necessary – $2.54\text{CM} = 1''$). This needs to be calculated based upon the tire size you use on your robot

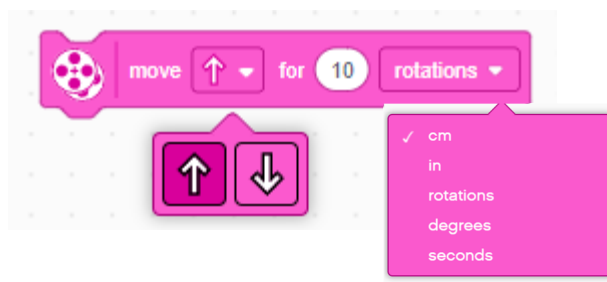


- i. HOW MANY CM DOES THE ROBOT MOVE IN 1 ROTATION (METHOD 1)
 1. Look up the wheel size in MM printed on your tire and divide by 10 to convert to CM ($1\text{cm} = 10\text{mm}$)
 - a. LEGO Wheels and their diameters – <http://wheels.sariel.pl/>
 2. Multiply your answer by 3.14 (pie) to computer the circumference
 3. Use this value to set the motor rotation block



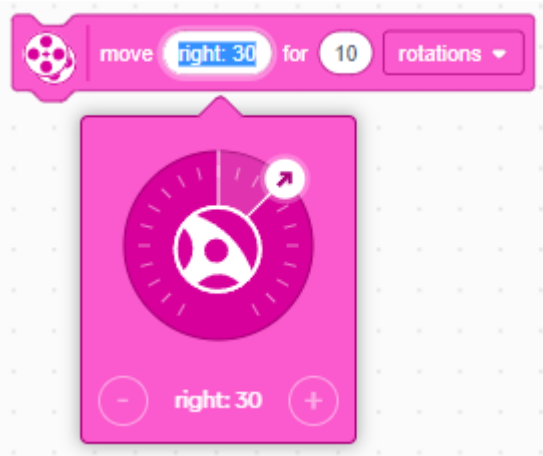
- a.
 - ii. HOW MANY CM DOES THE ROBOT MOVE IN 1 ROTATION (Method 2)
 1. Use the dashboard on your tablet to view sensor data to find the motor degrees value
 - a. Put a ruler next to your wheel at 0 CM (any easy to discern point)
 - b. Roll your robot forward slowly until the motor encoder reading reaches 1 rotation or 360 degrees.
 - i. Review your ruler and see how far the robot traveled on your ruler. Enter the data into the program per method 1 above

- b. MOVEMENT FOR DURATION – This is the simplest move block



PROGRAMING HELP continued.....

- c. MOVEMENT WITH STEERING – This block controls steering by giving different power levels to each wheel. It is NOT degree of robotic turn. The higher the number the sharper and faster your robot will turn. Think of it as speed to the wheels



- i.
d. TANK TURNS – This block allows you to control your turn by operating each motor at different speeds. This block is found in the Palette Extensions under more movement palette

LEFT AND RIGHT WHEEL SPEED

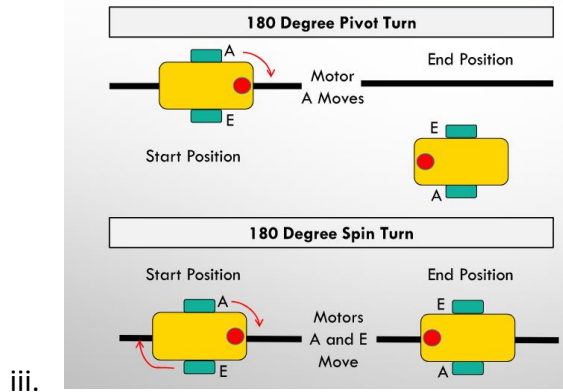
DURATION/ MODE OF

DISTANCE OPERATION



e. TYPES OF TURNS

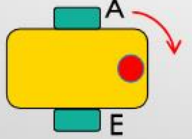
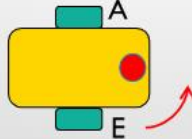
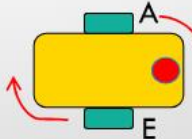
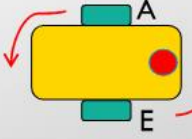
- i. Pivot Turn (Top image) take more space but tend to be more accurate
- ii. Spin Turns (Bottom Image) – Are faster but less accurate



PROGRAMING HELP continued.....

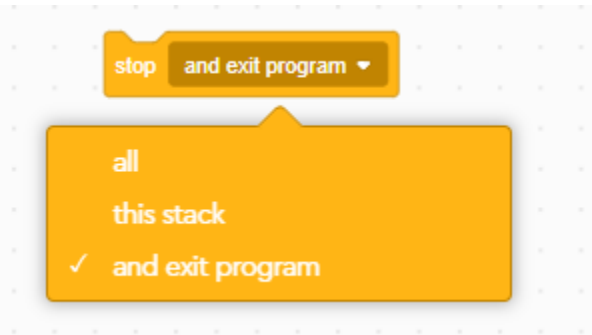
MOVEMENT continued.....

iv. Utilize the TANK TURN BLOCK to complete the following turns

Move Tank Values			
Speed, 0	0, Speed	Speed, -Speed	-Speed, Speed
			
Pivot Turn Right	Pivot Turn Left	Spin Turn Right	Spin Turn Left

3. ENDING your program

- a. All programs must be stopped or the robot block will be awaiting another control direction. Use the “STOP and EXIT PROGRAM” option for best results with your competition robot



b.

4. Programs are successful when they repeat (3) times in a row

- a. Robot Readiness help
 - i. Sometimes the robot needs a warmup period to be accurate. It is helpful to have a base program that makes your robot spin in circles for 50 – 100 times in each direction.
 - ii. Small dirt, table imperfections, lack of traction plays a large role in the accuracy of your robot. Make sure the wheels stay clean and the table surface remains smooth across the mat.
 - iii. Mats tends to move and are not allowed to be secured in the competition – make sure the mat is in the same location on the board at all times. It should be centered on the challenge board and having the long edge of the mat closest to the home plate tight against the challenge board perimeter.

SENSORS

1. TOUCH SENSOR (Force sensor)



- a.
- b. This sensor gives the robot a sense of touch. It can detect if it is being pressed and the amount of force applied. It measures in newtons or as a percentage (100% = 10 newtons)
 - i. Touch Sensing activation: 0 to 2mm
 - ii. Force sensing activation: 2 to 8mm
 - iii. Activation on force: 2.5 to 10 newtons
 - iv. Resolution: 0.1 newtons
 - v. Accuracy +/- 0.65 newtons

SENSORS continued.....

2. COLOR SENSOR (Color, light sensor)



- a.
- b. Install 15-20mm from the object for optimal function (it will not work when touching) (approx. ½" to ¾") (Approx (2) stacked lego technics blocks)
- c. The light sensor has (2) block programing modes: color, reflected light. It may also be used as a light source
 - i. Color – In this mode it can differentiate (8) different LEGO colors

Mode	Output range
Color	-1 = No object 0 = Black (LEGO:26; R:0, G:0, B:0) 1 = Magenta (LEGO:124; R:144, G:31, B:118) 3 = Blue (LEGO:23; R:30, G:90, B:168) 4 = Turquoise (LEGO:322; R:104, G:195, B:226) 5 = Green (LEGO:28; R:0, G:133, B:43) 7 = Yellow (LEGO:24; R:250, G:200, B:10) 9 = Red (LEGO:21; R:180, G:0, B:0) 10 = White (LEGO:01; R:244, G:244, B:244)
Reflected light	0% = no reflection, 100% = very reflective

- ii. Reflected Light Intensity – The color sensor emits a light and measures the amount reflected back into itself from the surface you are testing against. It is measured as 0-100 with 0 being very dark and 100 being very bright.

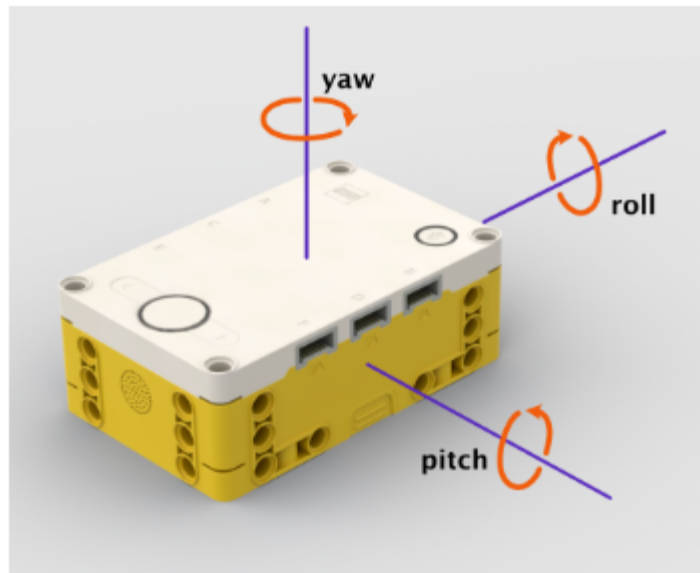
SENSORS continued.....

3. DISTANCE SENSOR (Ultrasonic)



- a.
- b. The distance sensor measures distance to an object or surface using ultrasound. The sensor works by sending out a high frequency sound wave that bounces off any object in range. It then measures how long it takes the sound to return to the sensor. The distance sensor can also be used as a light source with (4) LED segments around the eyes that can be controlled individually.
 - i. Distance sensing from 50 to 2000mm
 - ii. Fast distance sensing from 50-300mm
 - iii. White light output around the sensor eyes dividing into four segments – two upper (two lower are not accessible in Spike Prime Blocks)

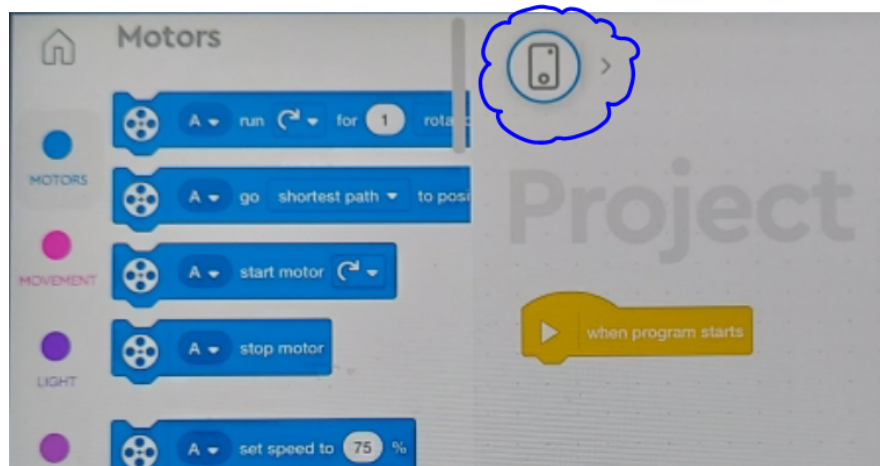
4. Gyroscope/Accelerometer (Rotation, Orientation)



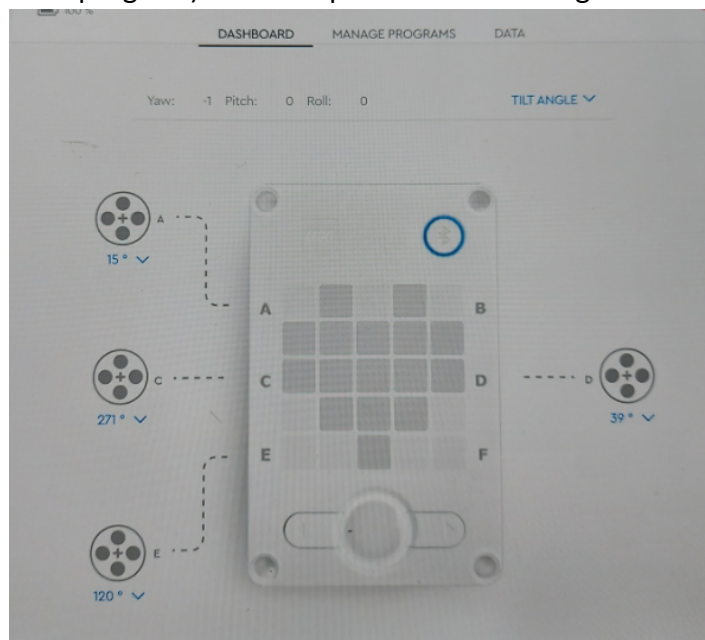
- a.
- b. The Spike Prime hub has several sensors built into it. These include a (3) axis accelerometer and a (3) axis gyroscope
 - i. Gyroscope – The hub can determine its rotation around these three axes as imaged above. It documents this in degrees per second and keeps track of the total angle of rotation in degrees.

ACCESSING THE SPIKE HUB MOTOR READOUTS

1. Each Motor/Sensor that gets plugged into the hub can provide specific readouts to the Spike Prime Control tablet. Typically we do not need to adjust these, but for sensors, you may need to adjust the readouts to get controls to work. As mentioned above, each sensor can provide various inputs/outputs. This is how you control which of these each sensor gives out to your programs
 - a. This is only available IF there are motors plugged into the spike prime hub AND your hub is connected to the Spike Prime App
 - b. Click the HUB connection button in the upper corner to enlarge the motor selections.



- i.
- ii. Each motor can be set for specific readouts (but not changed between each program). Use the pull downs to change



1.

APPROACHING THE GAME HINTS

- The starting position of the robot must be repeatable in a fast-set up location under time pressure.
 - A consistent starting position for all programs helps if students end up sick at competition or can't make it. Team member need to run the program the other had been working on all season.
 - Have the students work on jigs as these create fast accurate starting positions
- Start with simple programs that are close to home to begin with
 - Take time into account vs point evaluation
- Lego Robot Variability – Reaching the far end
 - Lego robots are not as precise as many higher end robots. Use items on the far end to help set your robot
 - Bumping into flat surfaces to re-square up your robot
 - Using sensors to follow a line to an end point to then start your next program
 - Travel until you reach a line
- Tackle actives that utilize the same attachment to avoid dis-assembly and re-assembly
- Find an order of challenges where kids can remove add- pieces rather than remove and add-on pieces. When they being feeling the pressure of the time they stumble with pieces
- When combining challenges, find challenges that do not require as precise accuracy of robot setup positions to combine
- Review challenges that may create obstacles for future challenge tasks – IE something rolls down a hill and now becomes an obstacle the robot didn't have to deal with originally.
- Team members who are not participating in the run should be helping other team members remember if pieces are setup correctly, the robot is in the correct location, or if something appears to be off so they can be ready to grab it and take the touch penalty
 - A touch penalty is better than having the robot stuck and all the other challenges fail due to lack of time.
- **No yelling at each other at the challenges. This will affect your core values. Practice gracious professionalism and coopertition.**

PROJECT PRESENTATION

Each year FIRST provides a new challenge for our students to research and develop a concept idea upon. 2021 was to understand shipping of supplies in the world, realize their challenges and therefore develop something that may help the shipping industry conquer one of these challenges. 2022 was to understand energy sources and find a way to further develop a renewable energy source. These research projects are a way to have our younger students begin thinking about how they can impact the world in an innovative manor. Students are to give a maximum of 5-minute-long presentation to a set of volunteer judges describing any or all of the below items:

- The problem they were given to solve (or chose to solve)
- The impact their solution will have on the community or the problem at hand
- History they researched in coming up with their problem and solution
- Their solution
 - A model, drawing, non-verbal video, presentation board etc are allowed and encouraged
 - Possible problems with solutions they may encounter while developing their solution
 - Any design processes they worked thru during their design of the solution (failures and successes)
- Resources they used to research their solution

Presentation Boards - In the past – teams have created a booklet to pass out or tri-fold (or more fold) presentation boards. Students should be encouraged to make the presentation feel as professional as the student feels it should be. Mentors may give suggestions and help students develop the board, but the overall board should be student designed and based. Ideas for the board are below:

- Drawings, diagrams, notes, photos of their solution
 - Hand drawn drawings and notes are fine if the students so wish, if students wish to do CAD or other scale drawings this is their choice but they should be student driven items.
- A list of resources
- About the team – Photos/notes (this is a good way to show off what else the team has done this season together to document some of the core values)
- A diagrammatic model of their solution (could be built from Legos or other materials)
 - A working model of their solution if the kids wish
- Photos or notes of their research process

COMPETITION

On competition day, there is more than just running the robot to the challenges. Teams will be evaluated upon (4) areas during the day which include: The robotic challenge run, the project presentation, team's robot design processes and presentation, and display of core values/Coopertition. CORE values and Coopertition are observed during the entire day.

Robot Playing Field

- **TIMELINE:** 2 minute 30 second run to complete as many challenges as possible
- **STUDENTS AT A TABLE:** A max of (2) student may be at the board per starting position
 - Students may tag out and let another in to complete another mission
 - If there are two starting positions on the field, players can not switch sides of the starting field even if they tag out, robot pieces cannot be swapped sides
- **STARTING:** Robot, Jigs, add-on accessories, and tools provided by the team **MUST** fit within the home position on the challenge mat. All add-on piece must be present.
- **ROBOT CONTROL:** No tablets are allowed at the challenge table. All programs must be downloaded to the robot prior to the competition run.
- **REVIEW OF THE PLAYING FIELD:** Students must review the playing field to ensure proper setup. Students are not allowed to fix errors on the field and shall politely inform the referee of the field error.
- **CHALLENGE RUN (You will run the field (3) times. Your highest score is what counts):**
 - The robot must start from the home position (nothing can hang over the starting position home plate)
 - Students are not allowed to touch the robot once the program has been started and the robot has left the home plate area (white area of the mat)
 - The robot must run to the challenge activity, complete the challenge, and return to home without human touching. The robot may return to the starting plate on the mat OR any of the home areas on the side of the challenge board area. Students may not touch the robot until all of the robot has arrived in the home areas.
 - Touch of the robot during the run – there is a touch penalty token taken. Teams receive ONE free touch token per total challenge time run
 - If the robot completes the challenge task, but you touched the robot to bring it home, the challenge does not count.
 - You may re-run the challenge as many times as you would like within the 2:30 time window.
 - On the last run- the robot does not need to return home to gain the challenge points.
- **END OF GAME POINTS REVIEW:** One student shall approach the judge to discuss the points achieved during the challenge run.

COMPETITION continued.....

PRESENTATION TIME (total time 20 minutes)

- Mentors and parents are allowed to sit within the judging room during presentation but are not allowed to speak, help students, or cue students
 - If special requirements are needed for a student, mentors shall request this of the judges as soon as possible prior to the competition scheduling. Typically, a sticker is added to the judges' sheet informing them of a team's special needs. The student will not be singled out to the judges.
- Students must bring in all supplies needed for their presentation including:
 - Robot and all add-on attachments
 - Means to display their programming skills (tablet or print-offs)
 - No exception will be made for tablets that do not turn on or function during the presentation
 - Presentation materials (tri-fold, booklets to pass out ect), models etc.
 - Typically, a table is provided for the presentation. Students must ensure there is one or provide one if necessary
- Presentation Rooms
 - Students will be assigned to a specific-colored presentation room (3-5 separate rooms). All teams at competition are assigned a 20-minute timeslot to give their complete presentation to a group of 2-4 volunteer judges.
 - At the end of the judging the sessions, the judges of each room will meet as a combined team to discuss their rooms strongest teams for multiple categories.

Project Presentation

- Students will be asked to introduce themselves and may be asked how many years they have been involved in the FLL program.
- Students will be given a max of 5 minutes to give their PROJECT presentation.
 - All students should speak about the presentation
 - Students should be prepared to speak about how they made decisions for the presentation, IE why did they tackle the issue they presented and how did they as a group decide this was the version to present.
 - Students should be prepared to talk about meeting or discussing their solutions with any professionals outside their team about their idea.
- Judges will then spend 5 minutes asking questions about the PROJECT presentation. These questions will help the judges better understand the project and check to see to what level each student was involved in the project development. This is also time the judges will verifying student excitement about their project research solutions.

COMPETITION continued.....

Robot Design Presentation

- AFTER PROJECT PRESENTATION: Students will be asked to discuss their robot.
- Students will have 5 minutes to discuss their robot design, the design process they went thru (successes and failures), programming of the robot, and future desires of the development if they desire.
 - Students should be able to explain why they have the design they are presenting, why the add-on accessories are necessary, the decision making processes they used to come up with the finalized design, and their favorite program/why.
- Judges will then spend 5 minutes asking questions about the ROBOT.

Core Values/History

- After the robot presentation and questions – judges will spend approx. 5 minutes accessing the group for their FIRST experience and enthusiasm.
- Judges will ask the students if they know their core values and can give examples of how their group displays these
- Judges will inquire further on conflict resolution processes between team members
- Judges may ask if students have been involved in spreading the knowledge of FIRST outside their physical team (school presentations, picnics, social events etc)
- Judges may ask if students know the basic history behind FIRST (Founder, Founder of Lego, what FIRST stands for)

Parent and Mentor Help

- **This day is about the students, their growth as a team, presentation as a team, and their designs and passions. Mentors and Parents are NOT allowed to be at the robot challenge board and may not help at all during the presentation. This includes setup and carry in to the robot challenge table OR the presentation room.**

FIRST WEBSITE RESPONSIBILITIES

The **team's lead mentor** will need to go to the FIRST website to setup their team's printable roster. Each student must fill out the liability release forms from FIRST prior to competition on the first website. The roster will indicate that the students and mentors have filled out this release. The mentors will also need to complete a background check prior competition.

- FIRST Website: <https://Firstinspires.org>
 - Upper right hand corner of the home page, click "Log-in"
 - Click the "Sign-up here" in blue below the log-in button
 - Once you log-in you will come to a page that has the word "DASHBOARD" at the top
 - MANAGING YOUR TEAM/PRINTING A ROSTER
 - Click on the "MY TEAMS" tab
 - If you do not see a team name listed below your TEAM list talk to your FLL program head. DO NOT SELECT "Create Team"
 - IF you see your team name
 - Go over to the "Team Contacts/Roster" area and select the pull down for "Contact Options"
 - From here you can select printable roster for competition
 - You can also manage your team from here
 - PERSONAL ACCOUNTS
 - In the far upper right hand corner you will see your name with a pull down option
 - This gives you notifications of new requests for information or invites
 - Allows you to control your profile, roles, acknowledgement forms, and Youth Protection Screening

RESOURCES

Lego

- <https://education.lego.com/en-us/lessons/prime-competition-ready/assembling-an-advanced-driving-base#lesson-plan>
- <https://education.lego.com/en-us/product-resources/spike-prime/downloads/building-instructions>
- <https://education.lego.com/en-us/lessons/prim-competition-ready>

FIRST Websites

- <https://FirstInspires.org>
- <https://www.firstlegoleague.org>

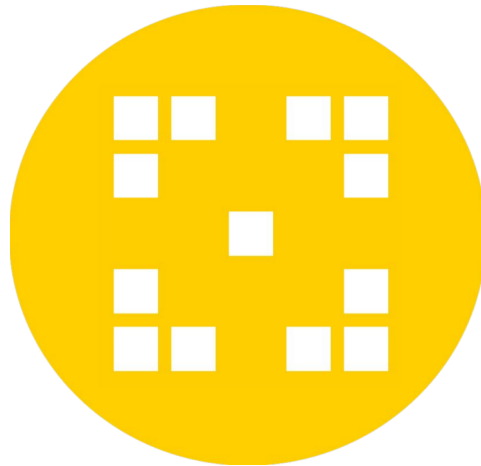
Facebook Groups

- **Brown County FIRST Robotics**
- **Lakeshore First Robotics** – Manitowoc’s FIRST Robotics group which was are partnered with to help our growth and development
- **FIRST Robotics**

APPENDIX

PROVIDED BY OTHER RESOURCES FOR YOUR HELP
SPIKE PRIME HAS GONE THRU SEVERAL UPDATES THEREFORE
SOME FEATURES MENTIONED BELOW MAY NOT BE AVAILABLE
DEPENDING UPON THE MOST CURRENT SOFTWARE

Unofficial SPIKE Prime Block Guide by PrimeLessons.org



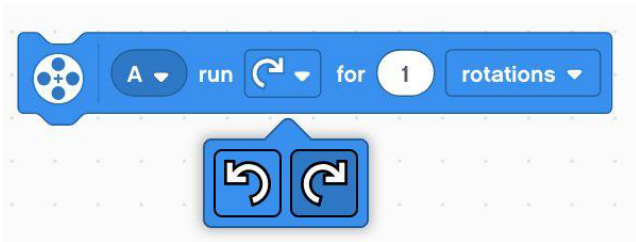
- Text descriptions based on SPIKE Prime Help Menu, but modified where necessary. Some blocks in the Help are not in the software. Other text in the Help does not match the actual block.
- To download additional programming blocks, click on the icon with blocks and a plus sign at the bottom left of the SPIKE Prime App and add the Extensions.



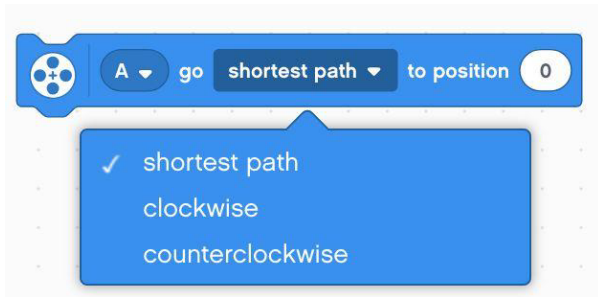


MOTOR BLOCKS

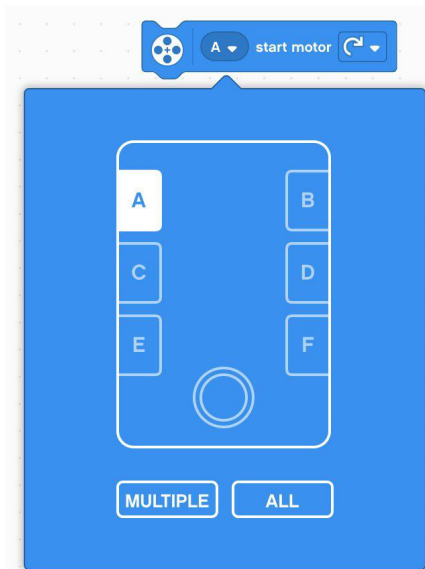
primelessons.org



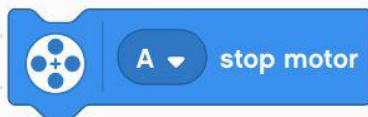
Run Motor for Duration: Tells the motor(s) to run in a clockwise or counterclockwise direction for a number of rotations, seconds or degrees. (Default speed: 75%, and Stall Detection enabled).



Motor Go to Position: Tells the motor(s) to travel the shortest path, clockwise or counterclockwise to the position selected (0-360). (Default speed: 75%, and Stall Detection enabled).



Start Motor: Starts the motor(s) turning in a clockwise or counterclockwise direction. (Default speed: 75%, and Stall Detection enabled).



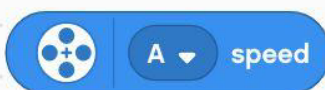
Stop Motor: Stops the motor(s) selected. The motor will brake, and will not post the position



Set Motor Speed: Sets the speed of the motor(s) to the maximum percentage (-100 to 100). Negative value reverses direction.



Motor Position: Reports the current position of the selected motor (0-359).



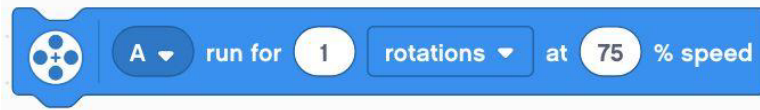
Motor Speed: Reports the actual current speed of the motor (-100-100).



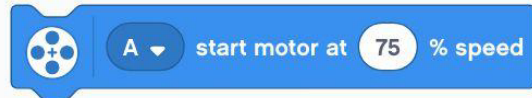
MORE MOTOR BLOCKS

You will need to add these blocks using Extensions.

primelessons.org



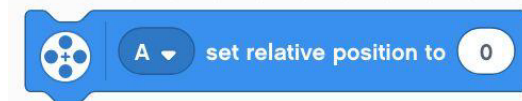
Run Motor for Duration at Speed: Runs motor(s) clockwise or counterclockwise for a number of rotations, seconds, or degrees at a specified speed (as a percentage or rpm). Stall detection is enabled.



Start Motor at Speed: Runs motor(s) clockwise or counterclockwise forever at the specified speed (percentage or rpm). Stall detection is enabled.



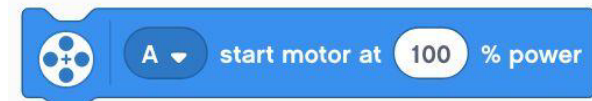
Go to Relative Position at Speed: Runs motor(s) to a relative position at the specified speed (%). Stall detection is enabled.



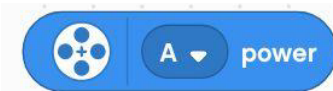
Set Relative Motor Position to 0: Sets the relative position of selected motor(s) to a specified value. "0" resets the relative position.



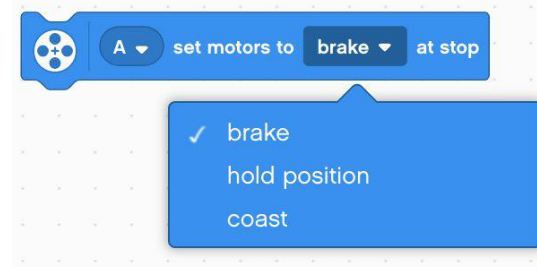
Relative Motor Position: Reruns the number of degrees the motor has turned since the program started or was reset to 0.



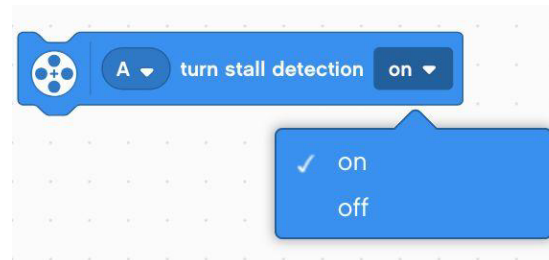
Start Motor with Power: Runs motor(s) at specified percentage of power forever. Stall detection enabled.



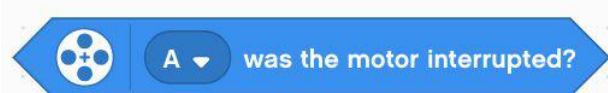
Motor Power: Returns the power level being used on a specified motor (in %)



Stop and Coast Motors: Defines how the motor will stop. Brake (default method applied friction to the motor). Hold (uses power to brake and moves motor back to the position it was stopped at). Coast (the power to the motor is cut when stopping)



Turn Stall Detection On/Off. Use this to disable Stall detection on motor and movement blocks. If stall detection is off, the motor will keep trying to complete even when physically prevented. If on, the code will move on to the next block.



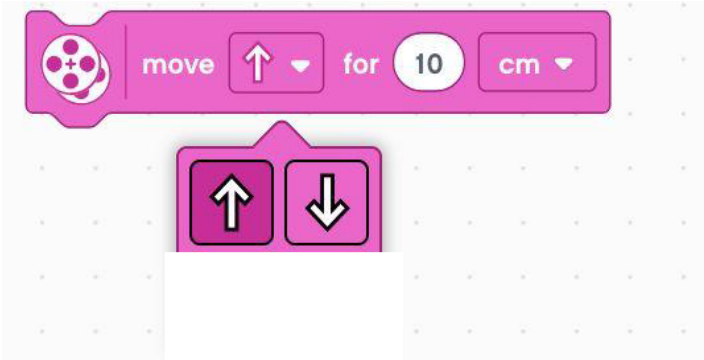
Was Movement Interrupted? If a motor block with a specified duration did not complete, it was interrupted.



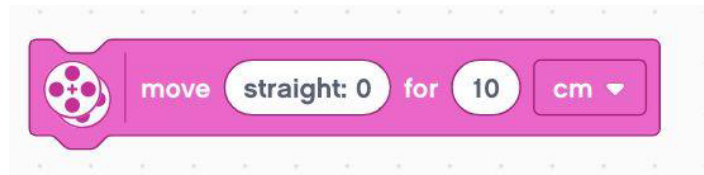
MOVEMENT BLOCKS

primelessons.org

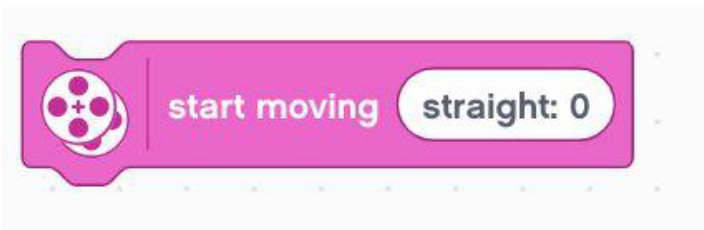
Movement Block motors are synchronized. They must be two of the same type.



Move for Duration: Move forward, backwards, left or right for centimeters, inches, rotations, degrees, or seconds. Distance moved in cm/in depends on what the “Set 1 Rotation to Distance Moved” block is defined as.



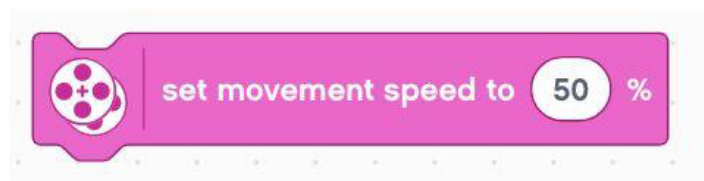
Move with Steering for Duration: Move forward, backwards, left or right for centimeters, inches, rotations, degrees, or seconds at a given steering. Left (-100), Right (100), Straight (0)



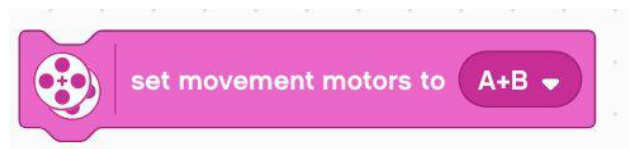
Start Moving with Steering: Starts the motors moving at a steering. Left (-100), Right (100), Straight (0)



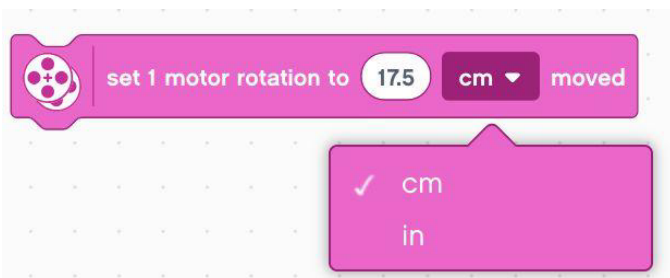
Stop Moving: Stops the motor(s) moving



Set Movement Speed: Sets the motors to move at a percentage of their maximum speed by default(-100 to 100).



Set Movement Motors: Defines which two motors are used for movement for your driving base



Set 1 Rotation to Distance Moved: Defines how many cm or inches one motor rotation equals.



MORE MOVEMENT BLOCKS

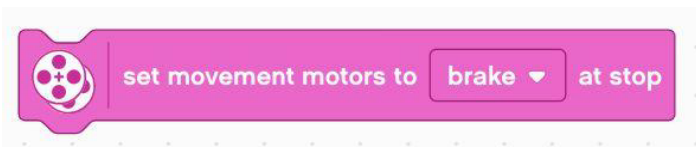
You will need to add these blocks using Extensions.



Start Moving at Speed: Moves the driving base forever at a specified speed for left and right motors.

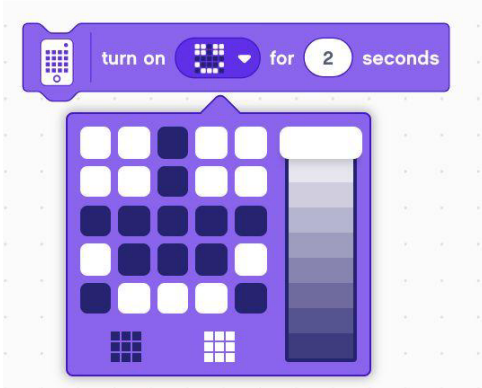
Set Movement Motors to Brake at stop
Determines how the motors will stop when using a Movement Block for a specified duration. Brake (Power to brake), Hold (Power to brake and motor moves back to the position when it stopped), Coast (Power to the motor is cut)

Did movement get interrupted? Returns true if the movement of the last motor block with a specified duration did not complete because a programming block interrupted it.





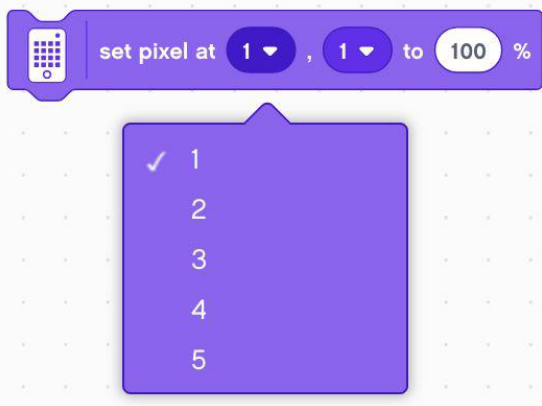
LIGHT BLOCKS



Turn on 5X5 Light matrix for Seconds: Create a pattern that lights up for a specific amount of time. Move the lever to change the intensity of the light.



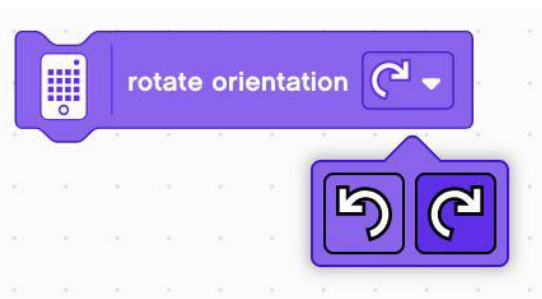
Set Pixel Brightness: Set the brightness of the 5X5 Light Matrix for the next block using the 5X5 Light Matrix. Default: 100%



Set Pixel: Set the brightness of individual pixels on the 5X5 Light Matrix.



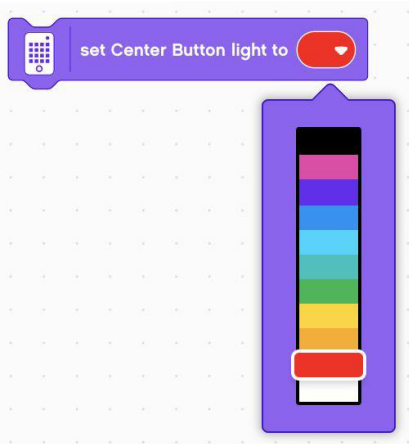
Set Orientation to (Upright): Set the orientation of what is being shown on the Light Matrix. Choose between upright, upside down, left or right. Default: Upright.



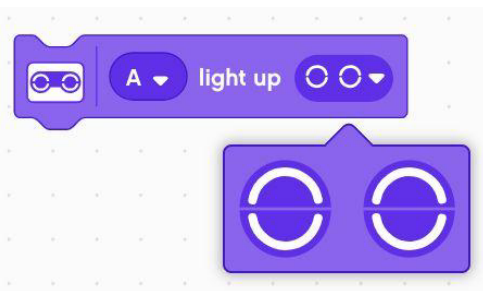
Rotate Orientation (Clockwise): Rotate the orientation of what is being shown on the 5X5 Light Matrix to clockwise or counterclockwise.



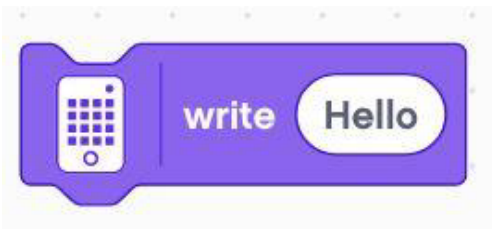
LIGHT BLOCKS



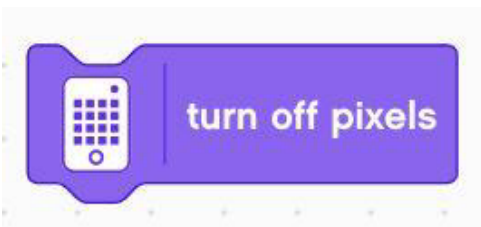
Set Center Button Light: Set the color of the Center Button light



Light up Distance Sensor: Turn on the lights on the four segments of the Distance Sensor



Write on 5X5 Matrix: Display a text string on the 5X5 Light Matrix that scrolls by



Turn off Pixels: Turn off the all the lights on the 5X5 Light Matrix.

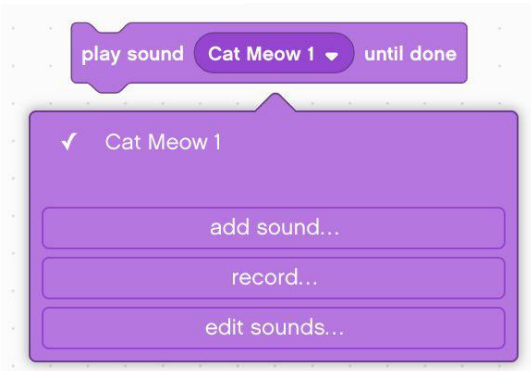


Turn on 5X5 Light Matrix: Create a pattern to light up on the Light Matrix. Pattern stays light until the Light Matrix is told to do something else or the program is stopped.

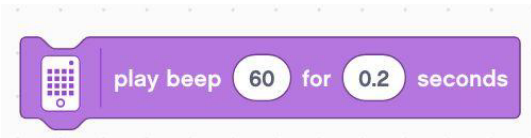


SOUND BLOCKS

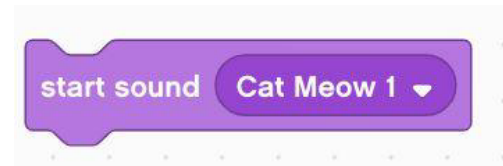
Most sounds (other than beeps) play on your device and not the Hub.



Play Sound until Done: Plays a selected sound on your device and pauses the programming stack until the sound is finished. You can add sounds, record sounds and edit sounds.



Play Beep for Seconds: Plays a beep tone on the Hub for the specified number of seconds.



Start Sound: Start playing a selected sound on your device and immediately plays the next block in the programming stack. You can add sounds, record sounds and edit sounds.



Start Playing Beep: Plays a beep tone on the Hub until something in the program stops it.



Stop All Sounds: Stops all sounds currently being played.



Change Pitch Effect By: Changes the pitch or pan left/right effect of the sounds played on the device
Pan effect: which speaker is emitting the sound. Left Speaker (-100), Normal (0), and Right Speaker (100)



Set Pitch Effect By: Changes the pitch or pan left right/left effect of sounds that are being played on the device.



SOUND BLOCKS



clear sound effects

Clear Sound Effects: Sets both the pitch and pan left/right sound effect back to normal



change volume by -10

Change Volume: Changes the volume of the sound currently being played by a specified increment from the volume at which it's currently playing. Default (100%)



set volume to 100 %

Set Volume: Sets the volume of the sound. Default (100%)



volume

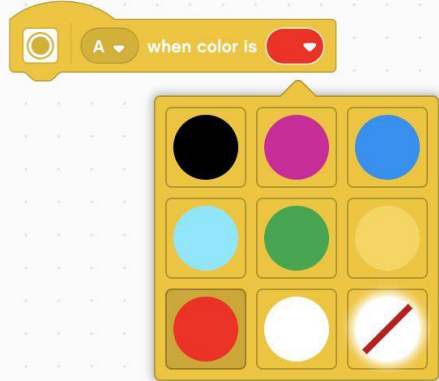
Volume: Reports the current volume



EVENT BLOCKS



When Program Starts: Plays all the blocks attached to it in sequence



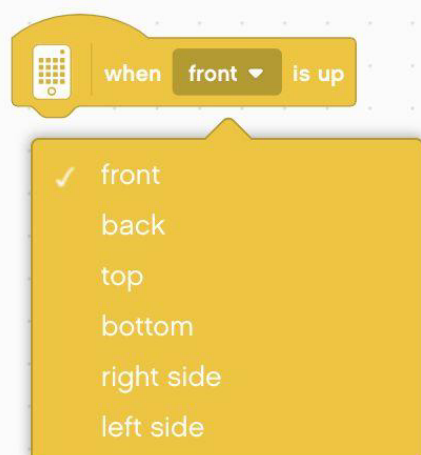
When Color Is: Plays all the blocks attached to it when the Color Sensor detects a specified color



When Pressure Is: Plays all the blocks attached to it when the Force Sensor is pressed, hard-pressed, released, or when a change in pressure is detected.



When Closer Than: Plays all the blocks attached to it when the Distance Sensor detects that an object is closer than or further than the specified distance.



When Hub Orientation is Up: Plays all the blocks attached to it when the Hub is placed in the specified orientation (front, back, top, bottom, left side, or right side)



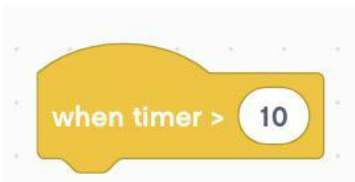
EVENT BLOCKS



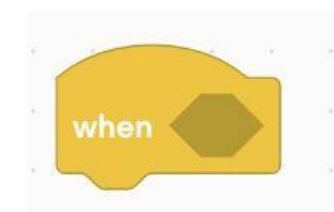
When Hub Shaken: Plays all of the blocks attached to it when the hub is shaken, tapped, or falling.



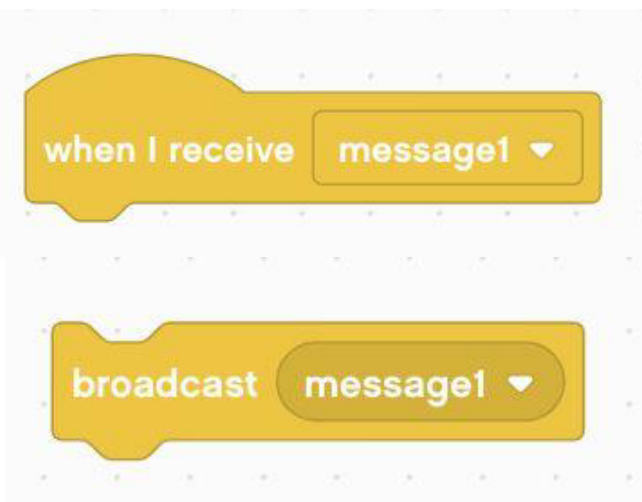
When Hub Button Pressed: Plays all the blocks attached to it when the Left or Right Buttons are pressed or released.



When Timer: Plays all the blocks attached to it when the time exceeds the specified value.

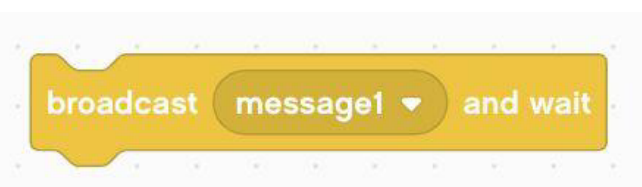


When: Plays all the blocks attached to it when a certain condition is true



When I receive Message: Plays all the blocks attached to it when a specified message is broadcasted by the Broadcast Message Block or the Broadcast Message and Wait Block.

Broadcast Message: Broadcasts a specified message. All When I Receive Message Hat Blocks for that specified message will play. After the message has been sent, the next block in the programming stack with play.



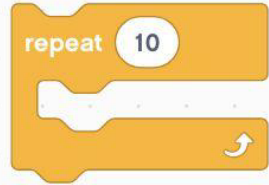
Broadcast Message and Wait: Broadcasts a specified message. All When I Receive Message Hat Blocks for that specified message will play. After the message has been sent, the block waits until all the programming stacks with the specified message finish before moving to the next block.



CONTROL BLOCKS



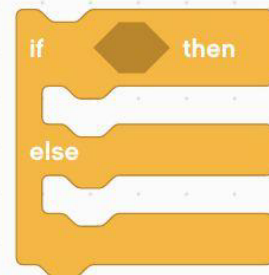
Wait for Seconds: Pauses the stack for the specified number of seconds (whole numbers and decimals)



Repeat Loop: All blocks in the loop will repeat for the specified number of times



If Then: The block checks whether a condition is true. If true, everything inside will play.



If Then Else: The Block checks whether a specific condition is true. If true then the the blocks in the first space will play and then the code continues down the stack. If false, the blocks in the second space play.



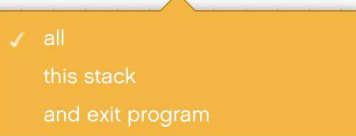
Wait Until: Pauses the stack until the condition is true



Repeat Until Loop: All blocks inside the loop will repeat until the condition is true



Stop other Stacks: The block stops all other programming stacks in the project except its own

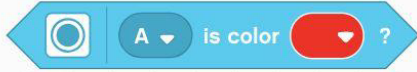


Stop: Block stops all programming stacks currently running, it's own programming stack, or exits the program.



SENSOR BLOCKS

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Is Color?: Returns “true” when the Color Sensor detects the specified color.

Color: Reports the color of the Color Sensor as a number code.

Is reflected light: Returns “true” when the light reflected back to the Color Sensor is greater than, equal to, or less than the specified percentage.

Reflected Light: Reports the value of the light that is being reflected back to the Color Sensor

Is Pressed? Returns “true” when the Force Sensor is pressed (> 0 newton), hard pressed (> 5 newton), or released (= 0 newton)

Pressure: Reports the current pressure being applied to the Force Sensor in newtons (2-10 newtons) or as a percentage.

Is distance? Returns “true” when the Distance Sensor detects something is closer than, exactly or greater than a specified distance.

Distance: Reports current distance the Distance Sensor is detecting (cm, in, percentage).

Is Hub orientation? Returns “true” if Hub is placed at angle specified (front, back, top, bottom, left side, right side)

Is Shaking? Returns “true” when the Hub is shaken, tapped, or falling.

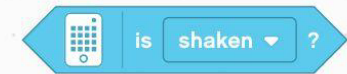
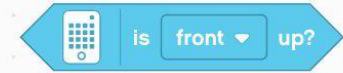
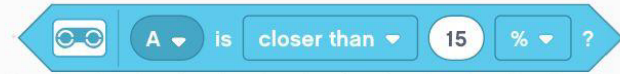
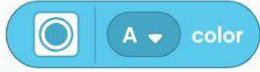
Hub Pits Roll Yaw Angle: Reports the Hub’s pitch, roll or yaw angle.

Set Hub Yaw Angle to 0: Sets the yaw = 0

Is Hub Button pressed? Returns “true” if Left or Right button is pressed or released

Time: Reports time (sec) since the program started.

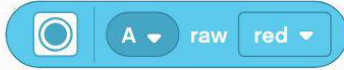
Reset Timer: Resets the timer





MORE SENSOR BLOCKS

You will need to add these blocks using Extensions.



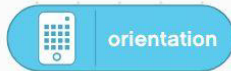
Raw Color: Returns the raw red, green, or blue color reading from the Color Sensor (0-255)



Hub Acceleration: Returns the Hub's acceleration on the X, Y or Z axis



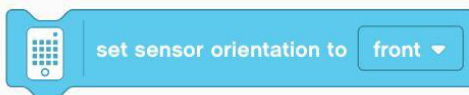
Hub Angular Velocity: Returns the Hub's angular velocity (Gyro Rate) on the X, Y, or Z axis



Orientation: Returns the current orientation of the hub (front, back, top, bottom, left side, or right side)



Gesture: Returns the current gesture (shaken, tapped, or falling)

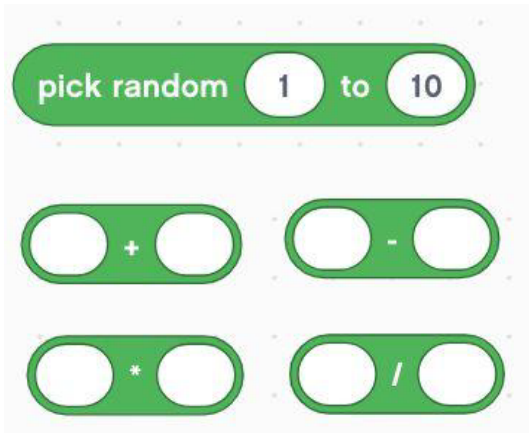


Set Hub Sensor Orientation: Set the orientation of the 6-axis Gyro Sensor to front, back, top, down, left side, or right side.



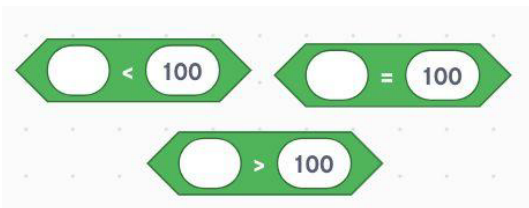
OPERATOR BLOCKS

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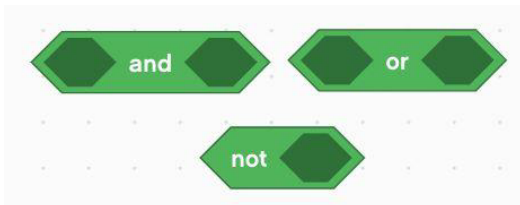


Pick Random Number: Picks a random number within the specified range (including endpoints). Whole numbers or decimals can be selected if the endpoints are decimals. If endpoints are whole numbers, only whole numbers can be selected

Plus/Minus/Multiply/Divide: Add, subtract, multiply or divide two values and return the results



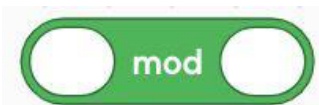
Greater Than/Less Than/Equal To: Returns true if value is greater than, less than or equal to.



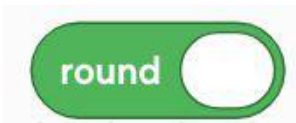
And/Or/Not: Joins two Boolean Blocks with “and”, “or” condition. Not inverts the boolean value of the condition inside.



Is Between: Checks whether the specified value falls between the next two specified values (including endpoints)



Mod: Returns the remainder when the first value is divided by the second. E.g. 10 mod 3 returns 1.

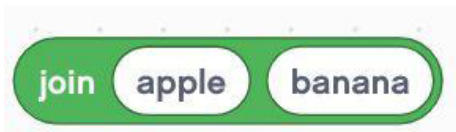


Round: Rounds the given number to the nearest integer. (.5 and higher round up)

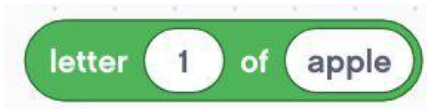


OPERATOR BLOCKS

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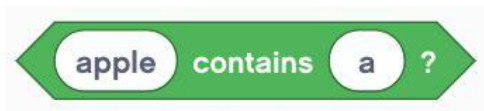
Join Strings: Join two text values and returns the results. E.g. “apple” “banana” would return “applebanana”



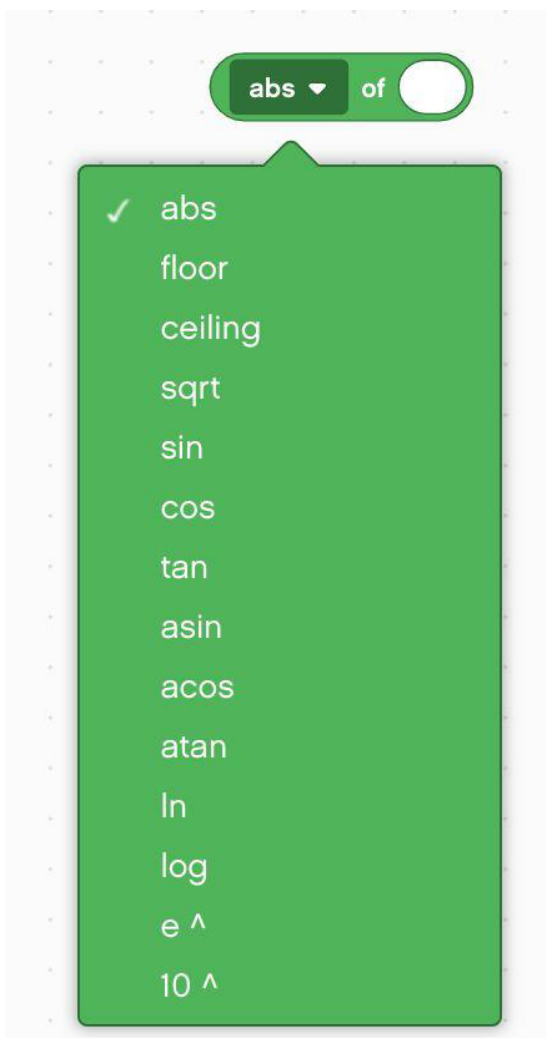
Letter of String: Returns the character that occupied the specified position. E.g. letter 1 of apple is “a”



Length of String: Returns the number of characters in the string. E.g If you enter “apple”, the block returns “5”



String Contains: Returns “true” if the specified character is contained in the string.



Math Functions: Performs the specified math function on a given number and reports the results.

BACKING UP SPIKE PRIME FILES

PRIMELESSONS.ORG

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Backing up SPIKE Prime Files

Authors: Manjiri McCoy and Bruce Schafer

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Why Should you Backup your Files?

Spike Prime program files have an extension “.lsp”. It is a good idea to back up files somewhere other than your iPad/laptop in case something happens to your device and you lose your files. This happens to teams **every single year** and they lose months of work and it is very sad.

NOTE: You **cannot** copy files from your Hub to your iPad/laptop. The hub contains compiled code (machine language) and is not a human-readable program.

Backing up on an iPad

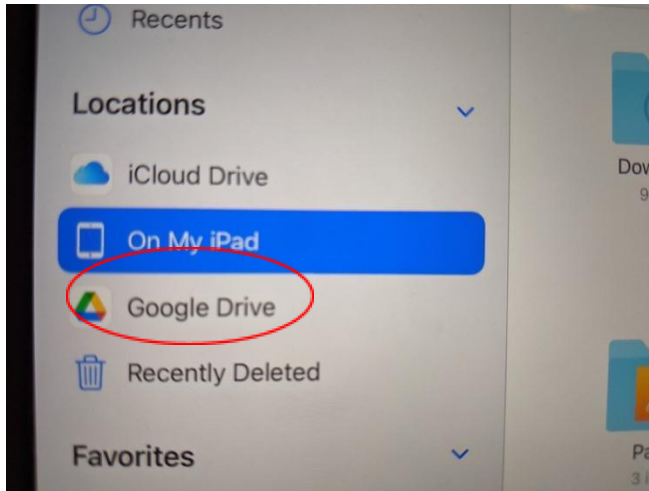
You need the Google Drive app and the Files app to back up your programs to Google Drive.

Google Drive setup:

1. From the Appstore, download and install the Google Drive App. It is published by Google and is safe.
2. Log into the app. Create a new folder called “Spike Prime” by clicking the “+” icon in the bottom right.

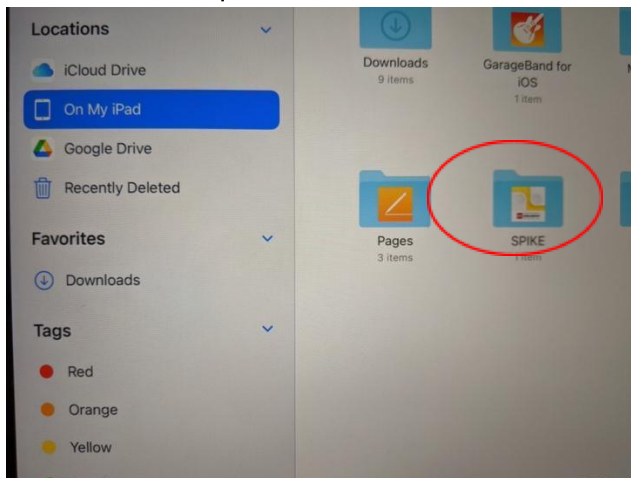
Files setup:

1. From the App Store, download and install the Files app. It is published by Apple and is safe.
2. Launch the app. On the right, in the side bar under “Locations”, you’ll see a notification to allow Google Drive as a recognized Location for files. Turn it on. Now Google Drive should be a recognized location.

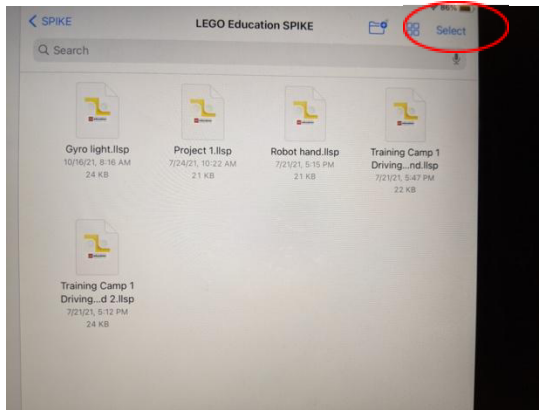


Backing up files:

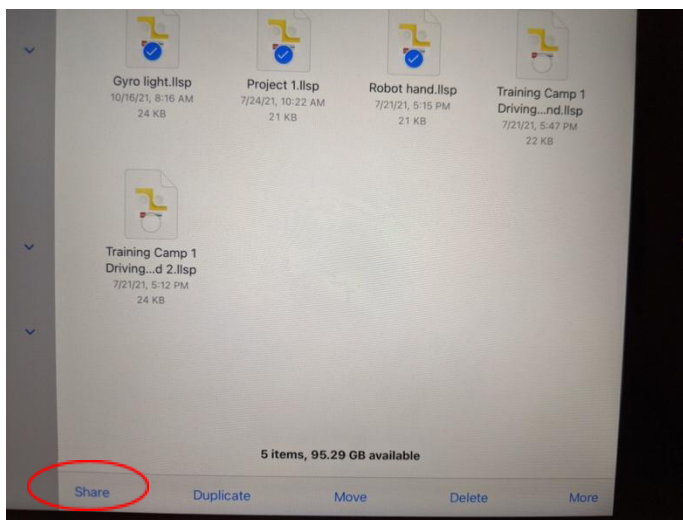
1. Select “On My iPad” from the Locations sidebar. You will see folders in the main panel, one of which is Spike



2. Click on Spike, and then on Lego Education Spike. You will see a list of .llsp files. These are your programs.
3. Click the “Select” link at the top right. Select the programs you want to back up



4. Click the “share” link in the bottom bar.



5. Scroll the available programs until you find Google Drive. Click it.
6. On the window that appears, click “My Drive” near the bottom, Then pick the “Spike Prime” folder.
7. When you’re in the folder, click the “Create Folder” icon at the top right. Make a new folder with today’s date starting with year YYYY/MM/DD. E.g. 2021/10/25
ALWAYS make a new folder when you have made changes to a program and are saving it for a second or more time. This way you can go back to an earlier version of your program if needed.
8. Once the folder is created, click the “Save here” link at the bottom right. You will be taken back to the main window.
9. Upload the selected files by clicking the “Upload” link at the top right.

Your programs are now saved to Google Drive.

Restoring Files

1. In the Files app, go to Google Drive and navigate to the folder that contains your file.
2. Press the file and drag it over "On My iPad" on the Locations bar. Keep the file pressed.
3. The folder will open. With the file still pressed, move over the Spike Folder. It will open.
4. Move over the Lego Education Spike Folder. It will open.
5. Now drop the file in here. You can replace an existing file or save as a new copy. They will now be available in your projects when you open your App.

Backing up on a Mac Laptop

On a Mac laptop, the .lsp program files are stored in one of two locations:

1. ~/Library/Containers/Spike/Data/Documents/LEGO Education SPIKE/
2. ~/Documents

Google Drive setup:

1. Go to Google Drive.
2. Create a new folder called "Spike Prime"

Backup

1. Open Finder app
2. From the toolbar, click Go-> Go to folder and copy-paste the first location listed above in the text box
3. You should see your .lsp files. If what you're looking for is not there, try the second location.
4. Open a browser window and go to Google Drive, to the Spike Prime folder
5. Make a new folder with today's date starting with year YYYY/MM/DD. E.g. 2021/10/25
ALWAYS make a new folder when you have made changes to a program and are saving it for a second or more time. This way you can go back to an earlier version of your program if needed.
6. Drag and drop files from your Finder Window to the Drive folder



Restoring Files

6. Open Google Drive in a browser and go to the folder that has your backed up file
7. Open Finder and navigate to the first location under the Library folder.
8. Drag and drop files from Drive to the folder. They will now be available in your projects when you open your App.

Backing up on a Chromebook

Exporting Projects from SPIKE Prime

The Chromebook version of the SPIKE Prime application does not store your Word Block projects in a standard place on the Chromebook. Instead it provides a way to “share” your projects which is really a way of saving a copy of a project as a file on your computer. To access this feature go to your My Projects screen to get a list of all your projects. Normally your projects will be displayed as a set of large icons that are miniature copies of your programs. If

you prefer a tabular click on the small  icon in the upper right. To return to the graphical display click on the  icon. To save a copy of one of your projects click on a small circle next to the particular project. This should cause the circle to turn blue and the word “Share” to the left of the icons we just discussed will become darker. Note, however, that if you select more than one project, the “Share” will not become darker because you can only share or save one file at a time.

Clicking on the “Share” menu item to bring up a file manager window. Don’t be surprised if nothing happens as you may not have a compatible file manager set up. In that case you’ll need to install one by using the following steps:

1. Minimize your SPIKE Prime application.
2. Start the Play Store application.
3. Search for Total Commander. (There are probably other file managers that will work but this is the one we’ll use in these instructions.)
4. Click on Install and wait until the installation has completed.
5. Return to the your SPIKE Prime application’s My Projects screen
6. Reselect a project.
7. Click on Share.

The Total Commander window should show “Save File As” at the top followed by the name of the project you chose followed by “.llsp” which is the extension that SPIKE Prime uses for its Word Blocks project files. The first time you do this you probably won’t have a folder set up on your Chromebook for you project files. To create a folder for your backup copies of your projects, use the following steps:

1. Click on the line that includes “My files”.

2. Click on the icon that looks like a folder with a “+” sign. You should see a box that says “Create new folder:” followed by a line to fill in with the name of a new folder. Try typing “My Projects” or something similar.
3. If it doesn’t let you type anything on the line, click on the white box below which will copy the words in the box onto the line. Replace the words with something like. “My Projects”.
4. Click OK. This will return you to the “Save File As” screen.

Click OK to save the project you selected earlier. This will return you to the My Projects screen in your SPIKE Prime application. You can now select a different project and then click on Share. This time you won’t need to create a folder. Instead you should see the folder you created earlier shown on a line under the name of your project file. If it isn’t, you can click on the three dots to the right of the blue arrow under that line to navigate to your folder.

Backing Up SPIKE Prime Project Files

The process above will give you backup copies of your files on your Chromebook but will not assure you have a backup if your Chromebook should fail.. To backup your project files to the “cloud” use the Chrome browser to navigate to “drive.google.com” and use the “+ New” button to upload your files. Instead of using Google Drive via your browser, you could use Play Store to install Google Drive on your Chromebook and use it to upload your project files.

You can also backup your files to an external device. For instance, you can copy the files to a USB drive.

Restoring a Project

Later, if you need to restore one of the projects from a backup copy, use Total Commander or another Chromebook file manager to navigate to your My Projects folder and double click on the backup file. Doing so will load it into the SPIKE Prime application and display it.

Transferring a Project to Another Computer

If you want to move the files to a Windows or Mac computer, you should copy or download them and move them to the LEGO Education SPIKE folder in the Documents folder. Once you have placed project files from your Chromebook in one of these folders, you’ll need to import

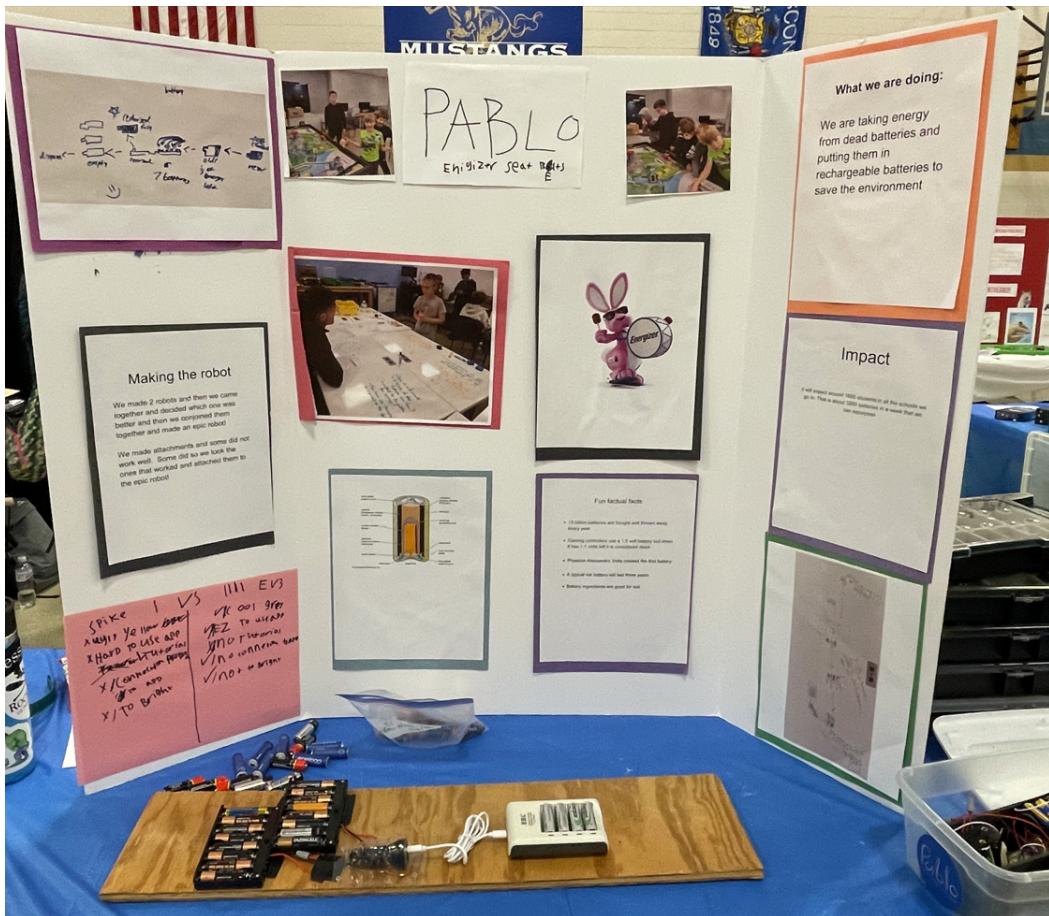
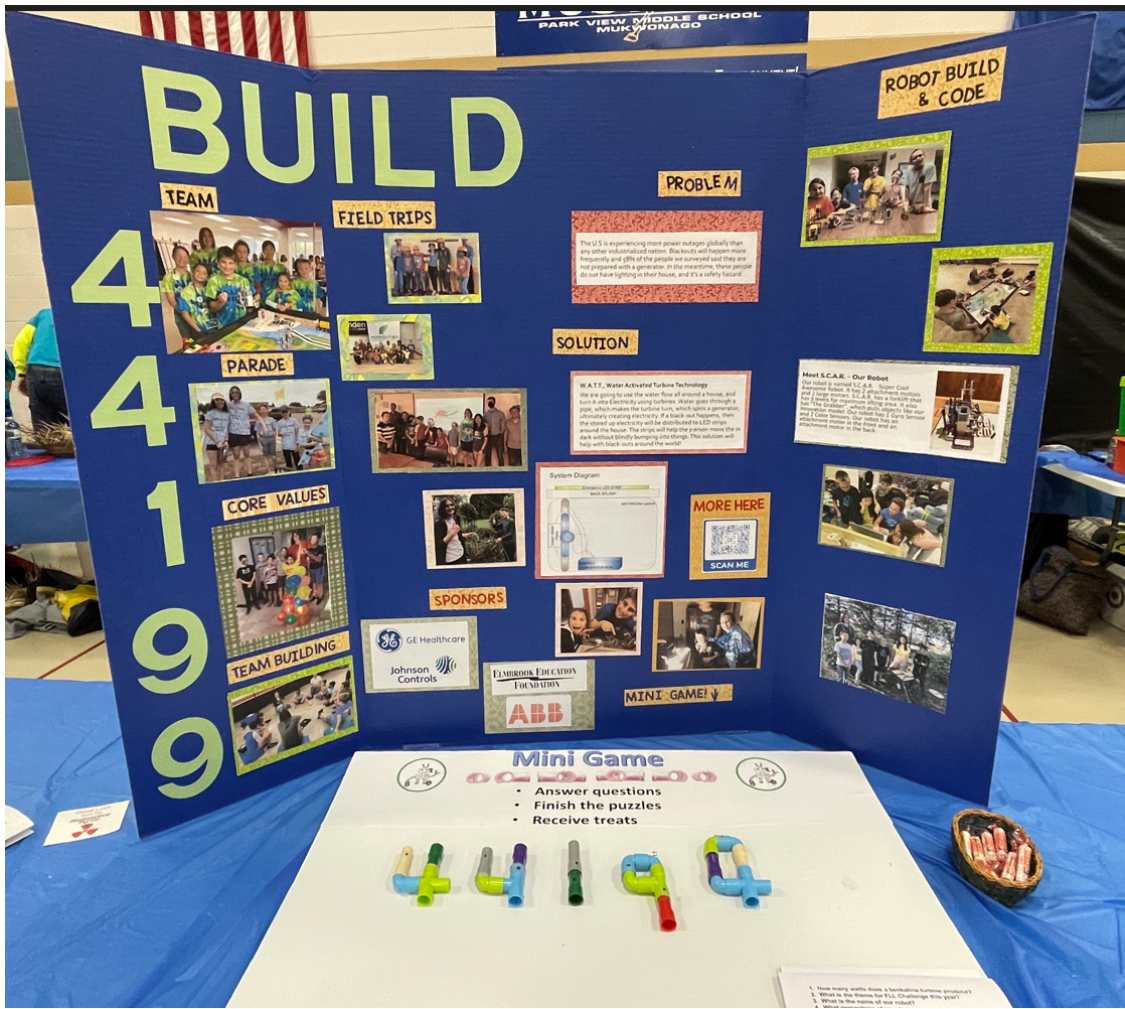
them into SPIKE Prime by displaying one of the projects already on that computer and then using the File Open feature to load the project. After you have loaded it this way once, it will appear with the rest of the projects on the My Projects screen.

If you want to move the files to a different Chromebook, copy or download them to the Chromebook and then use the steps under “Restoring a Project”.

EXAMPLE PRESENTATION BOARDS







TYPICAL COMPETITION FIELD SETUP

