C - Smoother Line Following

Learn about analogue inputs to make an even more sophisticated line following robot, that will smoothly follow any path.

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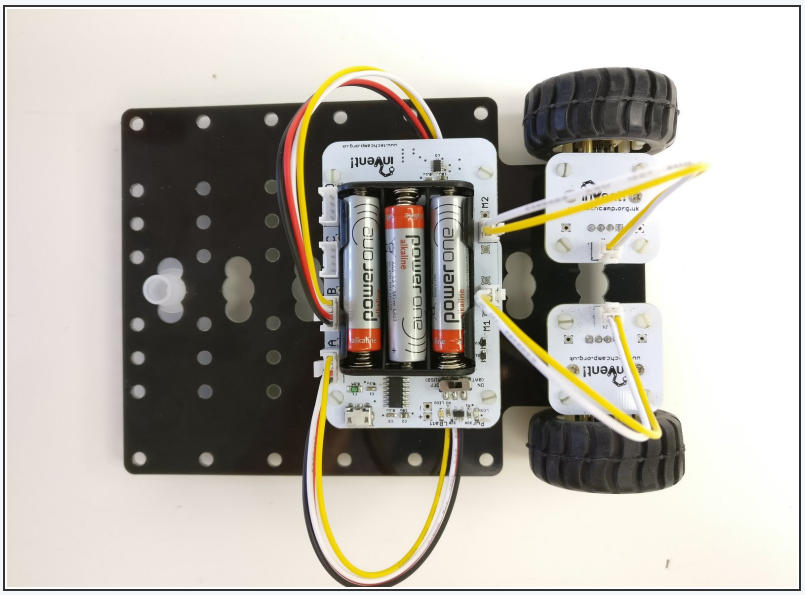
INTRODUCTION

Learn about analogue inputs to make an even more sophisticated line following robot, that will smoothly follow any path.

Step 1

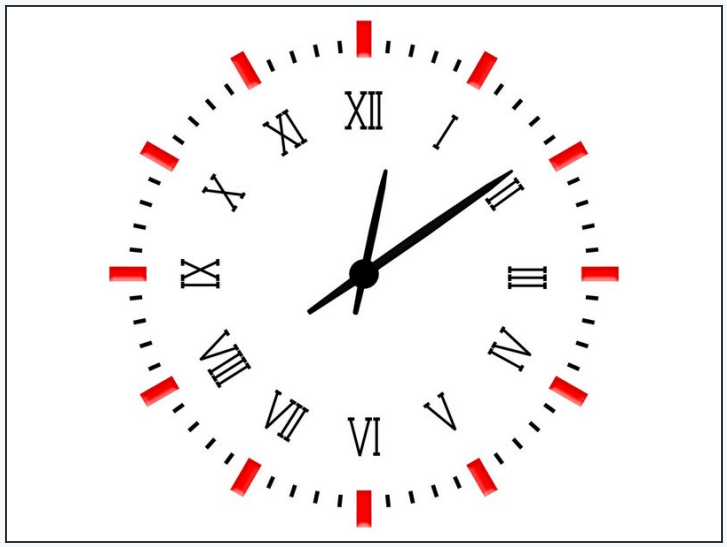
Setup Your Robot

- We just need the **line sensor** for now - make sure your robot is setup like the picture.



Step 2

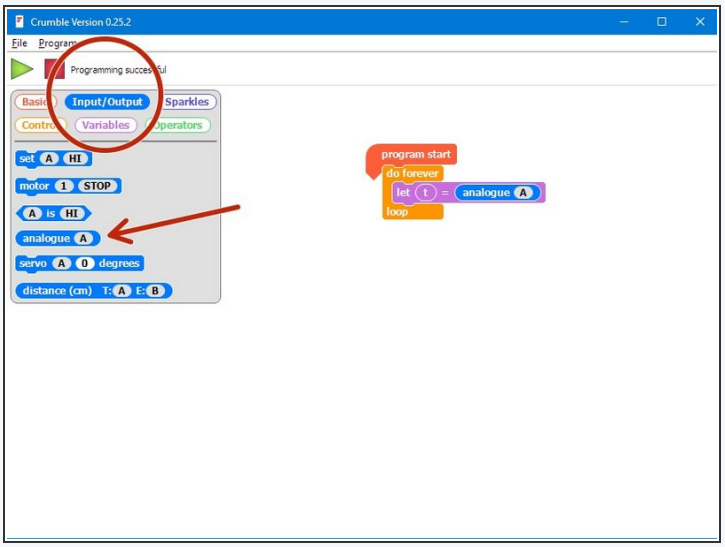
Analogue and Digital

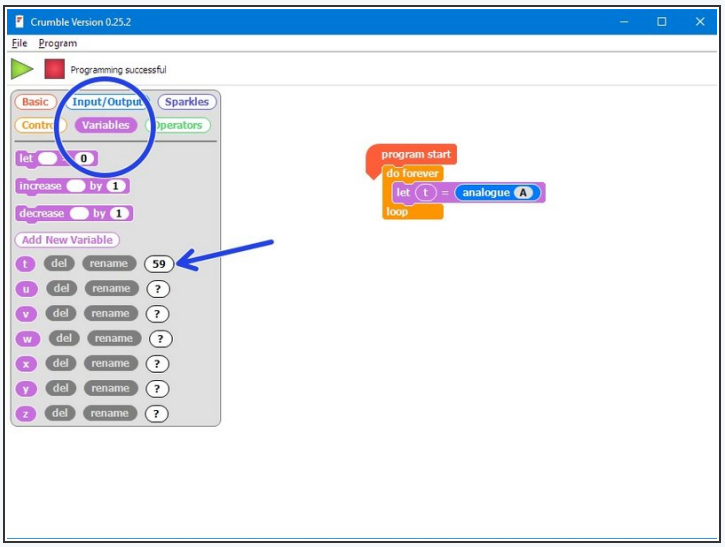


- To make a **smoother**, better line follower, we need to use the line sensor in **analogue mode.**
- So far, we have been using it as a **digital** sensor - it can only be **ON or OFF (HI or LO).**
- Analogue inputs (and outputs) can have **any value** - think about the difference between a digital and an analogue clock
- A digital clock must display a **whole number** of minutes
- But on an analogue clock, the minute hand can be **anywhere** - even halfway between two minutes!

Step 3

Analogue Line Sensor



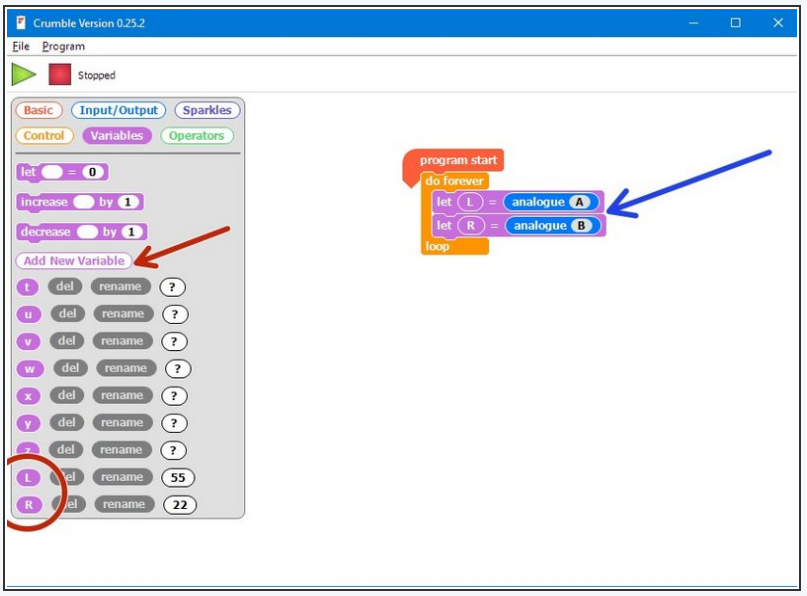


- **Build** the simple test program in the picture.
- You can find the **analogue** block in the **Input/Output menu**
- Program your robot, and **keep it plugged in.**
- Try moving the robot **slowly** from one side of the line to the other, whilst **watching the value of t** in the **variables menu.**
- See how it changes **gradually** as you approach the line?

Step 4

2 Analogue Sensors

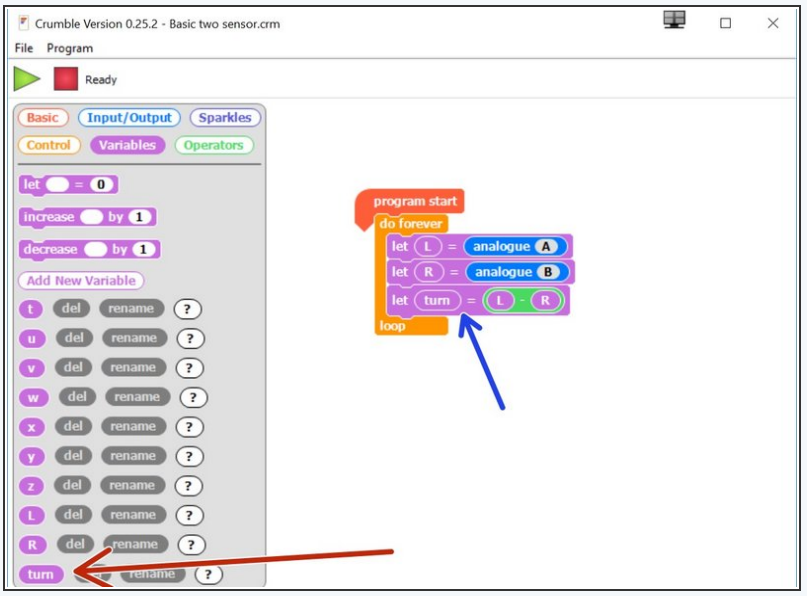
- We can use this **gradual** change to **smoothly** change the amount the robot turns as it get **further from the line!**
- Add two new variables to the program called **L** and **R** (left and right).
- Let **L** = the analogue value of the **left sensor**, and **R** = the analogue value of the **right sensor.**
- **Program** the robot and try **moving it slowly** across the track again whilst still plugged in - make sure L and R behave **how you expect** them to!



Step 5

How much to turn?

- The larger the **difference** between L and R, the further the robot is from the line so the **more** we need to turn.
- For example, if both sensors are on the line, we **don't need to turn at all** and L and R will have the **same value.**
- Add a new variable called **turn.**
- **After** getting the values of L and R, set turn equal to the **difference** between **L and R.**

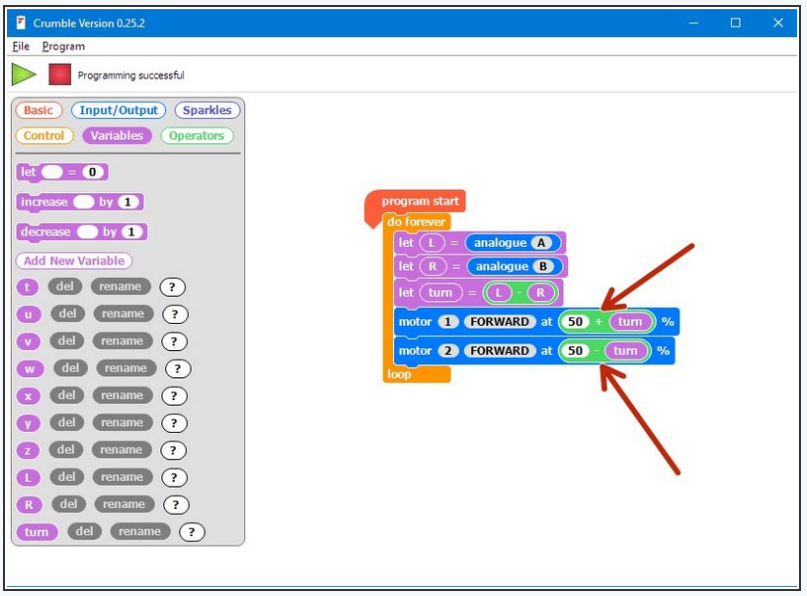


Step 6

Using the Turn

- **Program** your robot and watch what happens to the value of **turn** as you move it **across the line.** It should be **0** when the robot is exactly on the line!
- Let's use the turn variable to set the **speeds** of the motors.
- **Change** the motor blocks so they use the **turn variable** to set the speed like the picture.
- Test it out - this should follow the line **really smoothly!**
- Do you **understand** how the code works? (hint: turn is **positive** when we need to turn **right**, and **negative** when we need to turn **left**)

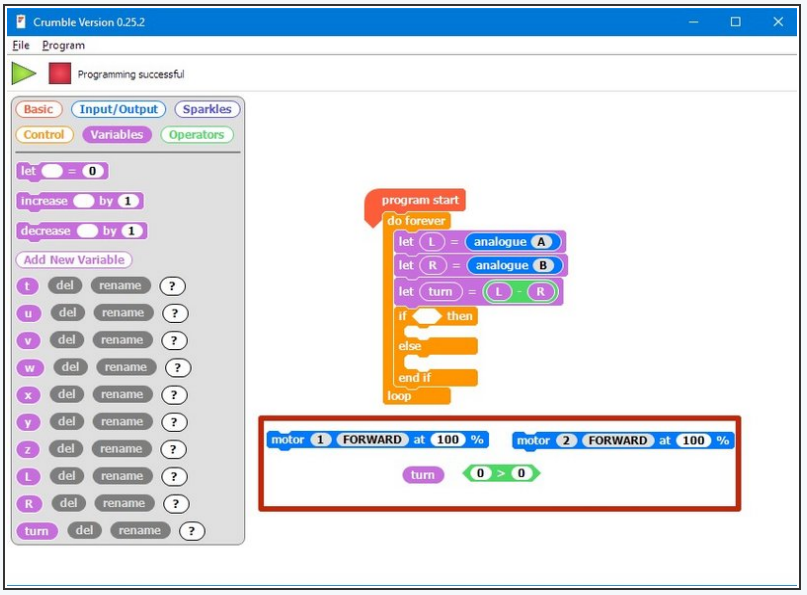
⚠ If you robot can't do the **really tight turns**, try multiplying turn by 2!



Step 7

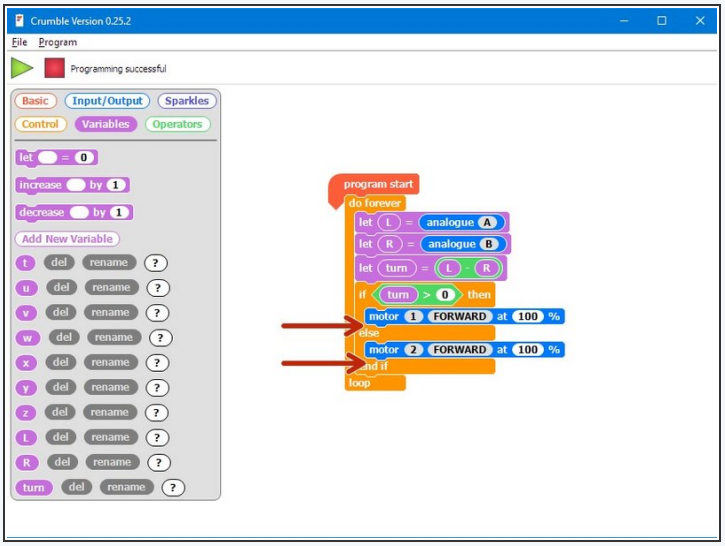
Maximum Speed

- You might have noticed that while the new program is **smooth**, it isn't as **fast** as the old two sensor **digital** program.
- To make it faster, we need to make sure 1 wheel is always going **100% forwards**, and then change the speed of the **other wheel only** based on how large **turn** is to follow the line.
- So, if turn is **positive**, we should be turning **right**, so motor **1** should be at 100%
- If turn is **negative**, we should be turning **left** so motor **2** should be at 100%
- Add an **IF/ELSE block** to check if **turn** is **positive** or not, and set the correct motor to **100%.**



Step 8

Proportional line follower



- Now its **over to you!**
- Add **two more motor blocks** into the IF/ELSE block to set the **other** motor's speed using the **turn variable**, for turning left and right
- **Test** the program really well - **experiment** with multiplying **turn** by different amounts to get a **reliable** line following program.

Here's a **hint** if you're confused - for the first part where **motor 1 is at 100%,** motor 2 should be set to **forwards** at a speed of **100 - turn.**

Step 9

Proportional Sparkles

- If you're feeling really advanced, add the **Sparkle module** back in and set the colours of the LEDs **proportionally** based on how far away from the line the robot is!
- Your robot can also **get lost** and now has no way of finding the line again - try and **add the code you wrote previously** back in so the robot can't get lost, or at least **stops** if it loses the line completely.