ROBOTICS ACTIVITY

WINGS OVER ROCKIES MUSEUM

HOLA (Hispanic Organization for Leadership & Awareness)
Lockheed Martin Employee Resource Group

LOCKHEED MARTIN

ZUMO ROBOT & CODING 101

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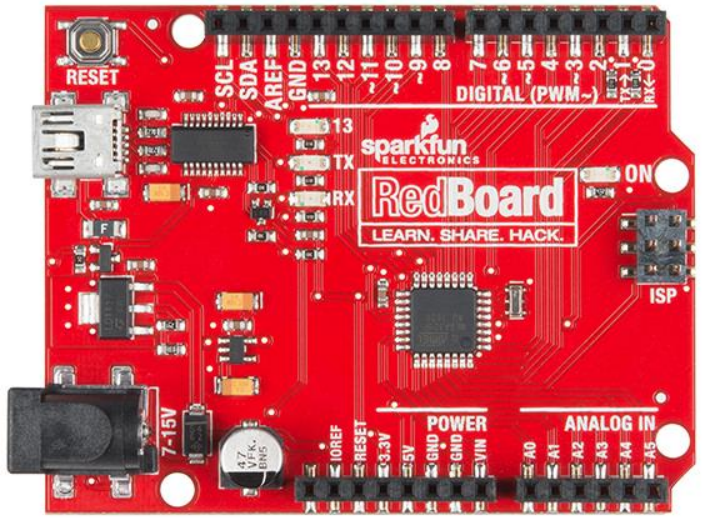
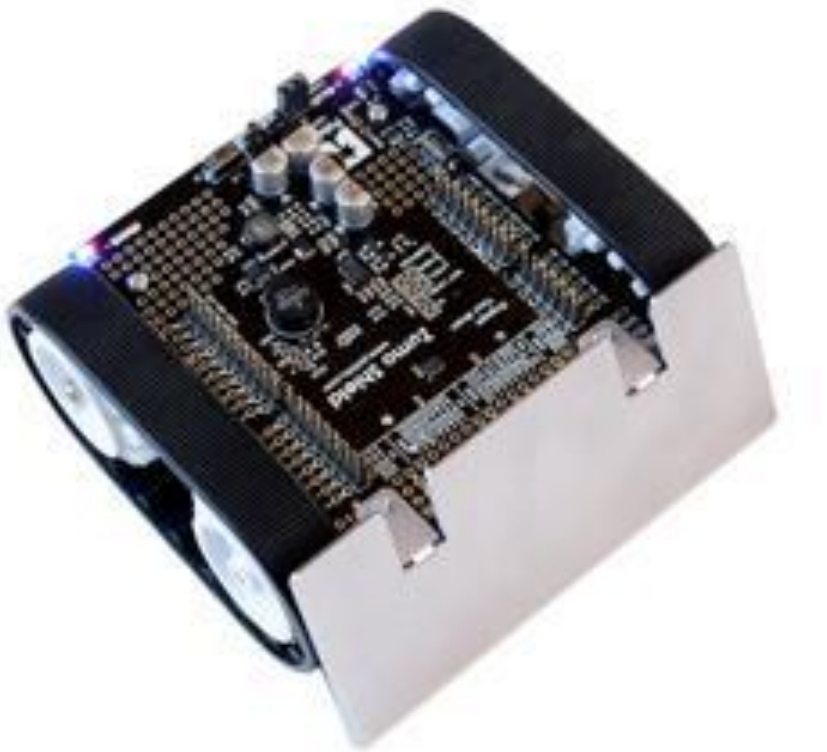
ZUMO ROBOT & REDBOARD

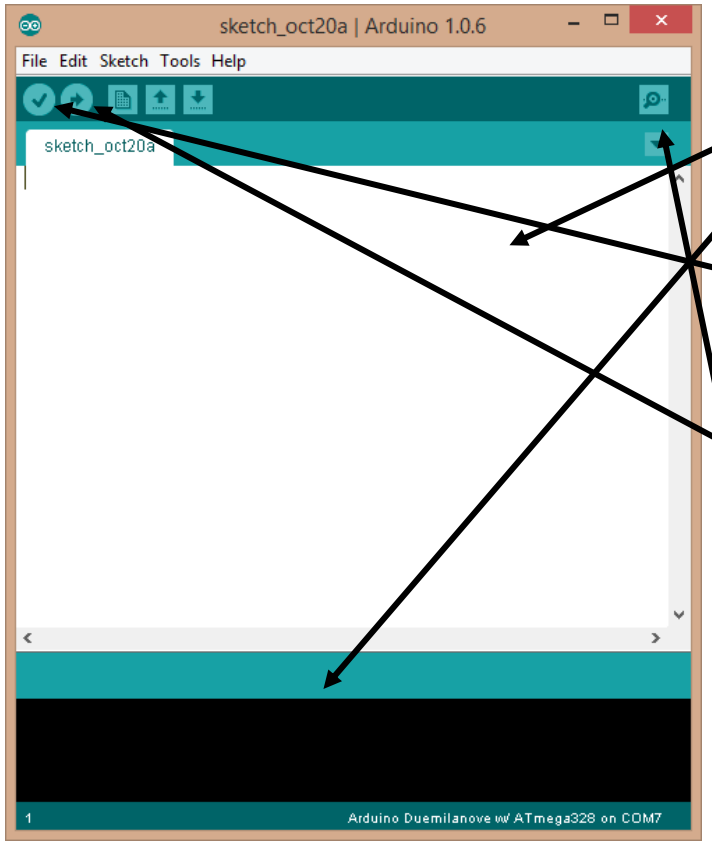


ARDUINO CODING PROCESS



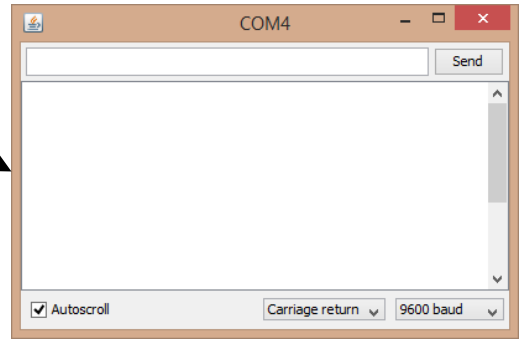
1. WRITE CODE
2. VERIFY CODE, FIX ANY ERRORS
3. CONNECT ARDUINO WITH USB TO COMPUTER (THE ZUMOBOT POWER DOES NOT HAVE TO BE ON FOR THIS)
4. UPLOAD CODE
5. ONCE UPLOADED, DISCONNECT THE ZUMOBOT
6. TEST (TURN ON ZUMOBOT)
7. REPEAT!

ARDUINO IDE



THE MAIN FEATURES YOU NEED TO KNOW ABOUT ARE:

- **CODE AREA:** THIS IS WHERE YOU WILL TYPE ALL YOUR CODE
- **INFO PANEL:** THIS WILL SHOW ANY ERRORS DURING COMPILING OR UPLOADING CODE TO YOUR ARDUINO
- **VERIFY:** THIS ALLOWS YOU TO COMPILE YOUR CODE TO CODE THE ARDUINO UNDERSTANDS. ANY MISTAKES YOU HAVE MADE IN THE SYNTAX OF YOUR CODE WILL BE SHOW IN THE INFO PANEL
- **UPLOAD:** THIS DOES THE SAME AS VERIFY BUT WILL THEN SEND YOUR CODE TO YOUR ARDUINO IF THE CODE IS VERIFIED SUCCESSFULLY
- **SERIAL MONITOR:** THIS WILL OPEN A WINDOW THAT ALLOWS YOU TO SEND TEXT TO AND FROM AN ARDUINO.



COMMENTS

- A COMMENT IS A STRING THAT IS IGNORED WHEN A CODE IS RUN. IT'S THERE FOR PEOPLE READING THE CODE: TO EXPLAIN WHAT THE PROGRAM DOES, HOW IT WORKS, OR WHY IT'S WRITTEN THE WAY IT IS.
- COMMENTS ARE CREATED EITHER BY PUTTING "//" FOR A SINGLE LINE COMMENT OR "/*" AND "*/" FOR A MULTILINE COMMENT

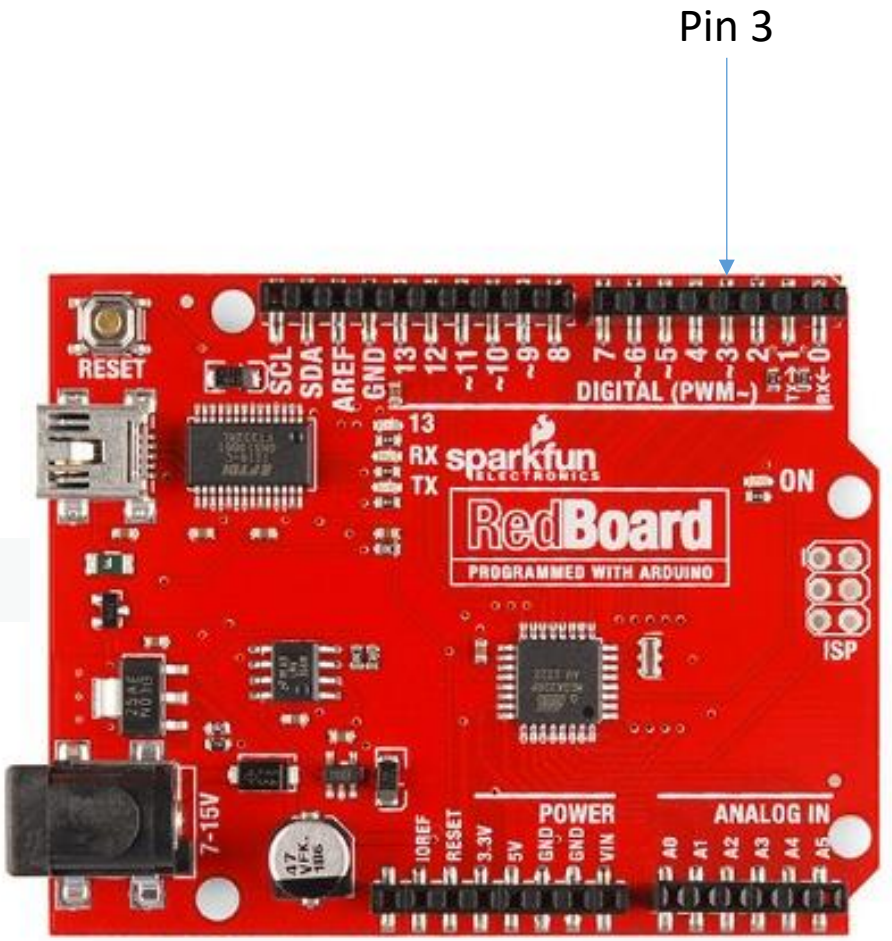
```
// this is a single line
/* this is
a multiline */
```

VARIABLES

- A WAY TO DEFINE A PIECE OF DATA.
- CONTAINS A TYPE, NAME AND VALUE.

```
int buttonPin = 3;
```

- TYPE: INT (INTEGER)
- NAME: BUTTONPIN
- VALUE: 3

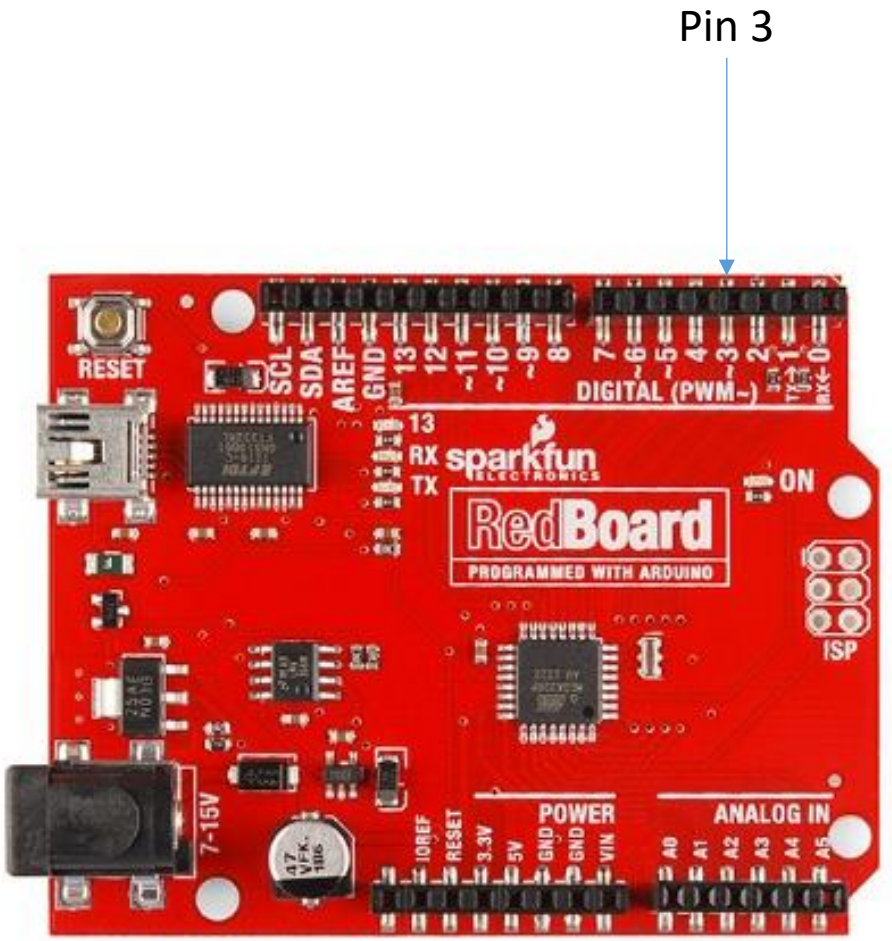


FUNCTIONS

- USED TO CONTROL THE ARDUINO BOARD AND PERFORM COMPUTATIONS
- CONTAINS THE NAME OF THE ACTION AND ITS PARAMETERS

```
void setup()
{
  beginSerial(9600);
  pinMode(buttonPin, INPUT);
}
```

- ACTION: PINMODE
- PARAMETERS: (BUTTONPIN, INPUT)



STRUCTURE OF AN ARDUINO SKETCH

```
int buttonPin = 3;

// setup initializes serial and the button pin
void setup()
{
  beginSerial(9600);
  pinMode(buttonPin, INPUT);
}

// loop checks the button pin each time,
// and will send serial if it is pressed
void loop()
{
  if (digitalRead(buttonPin) == HIGH)
    serialWrite('H');
  else
    serialWrite('L');

  delay(1000);
}
```

Variable

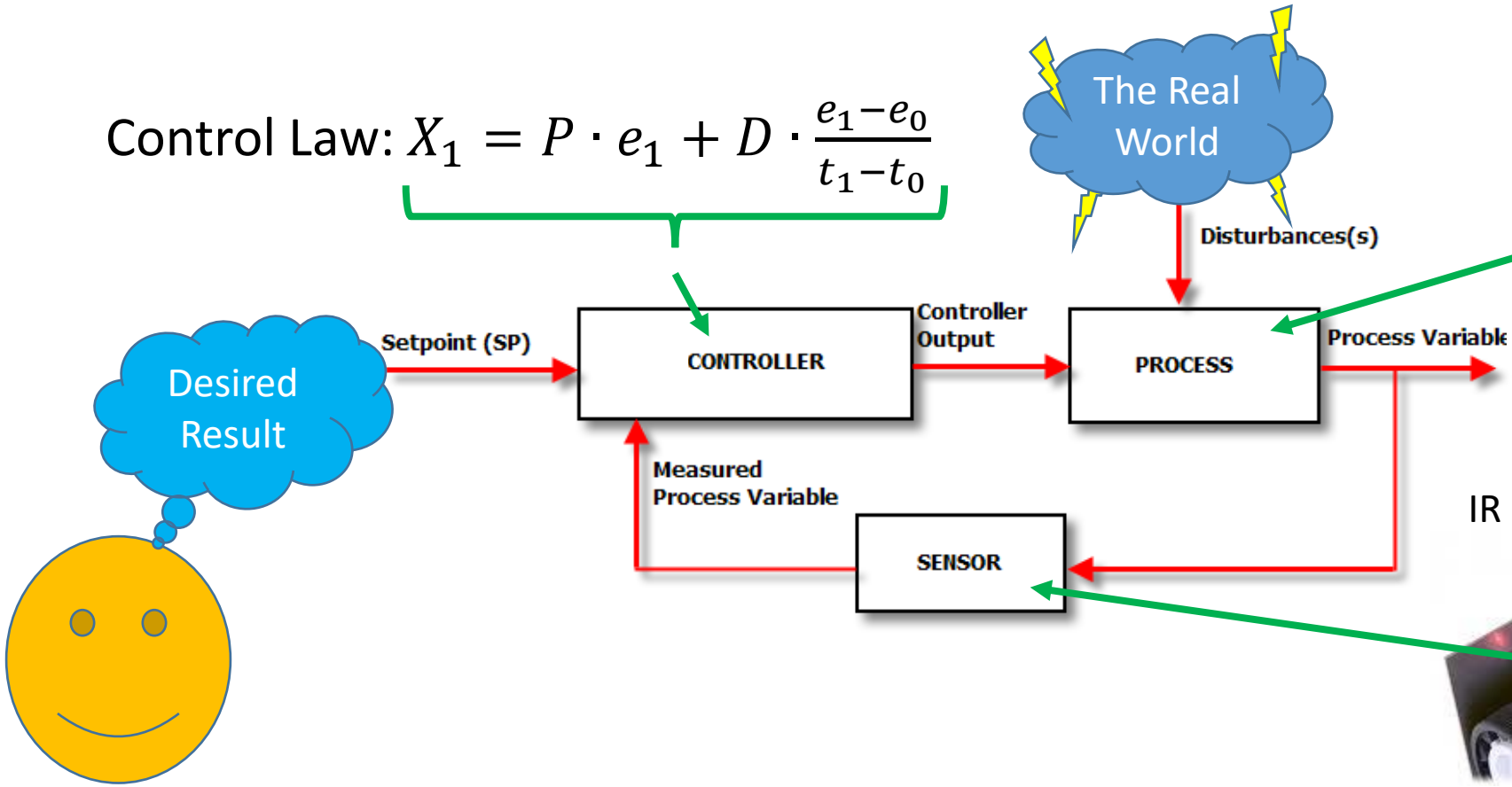
Function

Comment

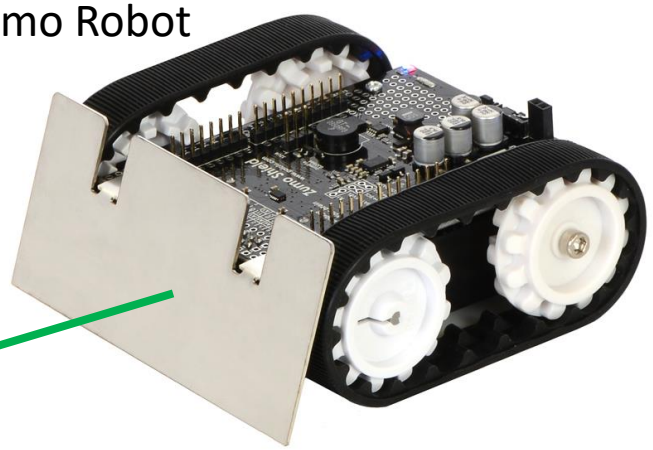
ADVANCED TOPIC – CONTROL SYSTEMS

- A CONTROL SYSTEM IS USED TO REGULATE A PROCESS BASED ON INFORMATION GATHERED FROM ITS SURROUNDINGS

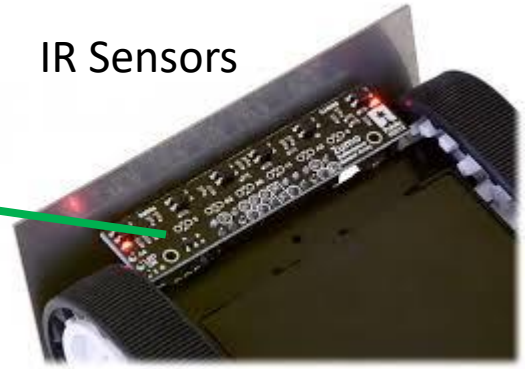
Control Law: $X_1 = P \cdot e_1 + D \cdot \frac{e_1 - e_0}{t_1 - t_0}$



Zumo Robot



IR Sensors



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- REDBOARD IS A PRODUCT OF SPARKFUN
- ZUMO ROBOT IS A PRODUCT OF LOPOLU

BACKUP SLIDES

TUNING OF A PD CONTROL LOOP

- WAYS TO TUNE:
  - Trial-and-error (manual)
  - Software simulators
  - Mathematical methods
- RULES OF THUMB:
  - Proportional (P) term has most direct effect on control
  - Derivative (D) term reacts to how fast the process variable changes
  - High P term may cause instability
  - D term can be used to smooth motions of robot and improve reaction to more complicated courses


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