LEMELSON-MIT

Celebrating invention, inspiring youth

CsforALL

CODING WITH JV INVENTEAM ACTIVITY GUIDES

WEBINAR | MAY 6 | 3-4PM EDT

Welcome and Introductions

George Kirkman

Lemelson-MIT InvenTeam Facilitator,

Educator,

& Robot Doctor with Rolling Robotics

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Fellow,

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- The Lemelson-MIT Program is funded by The Lemelson Foundation and administered by the School of Engineering at MIT.
- 15 years of experience working with educators and students developing ways of thinking and skills needed to invent.
- Students develop technological solutions to solve real-world problems.

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Research Informing Our Views On Coding

- Lemelson-MIT Program's study on the gender gap and three young women published in NAI journal: https://doi.org/10.21300/19.4.2018.735

- Research on preparing the next generation of inventors published in NAI journal: https://doi.org/10.21300/20.3.2019.161

- "Changing the Game in STEM with Family Engagement" can be found here: https://43ot971vwwe7okplr1iw2ql1-wpengine.netdna-ssl.com/wp-content/uploads/2019/04/Changing-the-Game-in-STEM-with-Family-Engagement.pdf

The Challenges

High-quality: most students don't have access to quality courses and learning opportunities that form coherent pathways.

Integral: CS is not yet established as a discipline.

All students and teachers: we don’t yet have the capacity to serve them all.

Free Resources for Teachers and Students

JV InvenTeam activity guides available at http://lemelson.mit.edu/resources

Wearable Technology

Design and Pattern Transfer

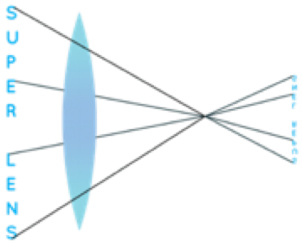
Human Power and Energy

Urban Hydroponics

Speakers and Instruments

Heating and Cooling

Simple Machines



Optics

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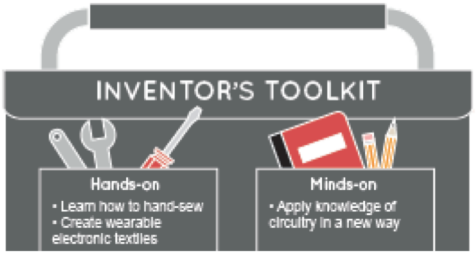
JV InvenTeam Guide Example

MEETING 4

Electronic Textiles
Meeting 4: Sewing & Electronic Textiles



KEY TERMS

Short circuit (n) Accidental contact between two points in an electric circuit that have a potential difference.

Trace (n) Thread connections between electronic components.

EDUCATOR NOTE

Note on Meeting 3
Learning how to sew takes time. It's possible that the majority of this meeting will be spent on learning how to sew. Ideally, students will at least get started on their textile during the end of this meeting. If needed, they can be encouraged to continue at home.

SAFETY

Sewing needles have sharp ends so use caution as you learn how to thread a needle and sew. Threaders are provided to help you get started.

Tools

- Scissors
- Sewing needles
- Threaders

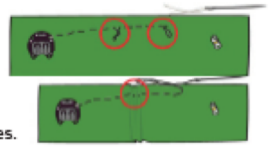
Materials

- Student Guides
- Projector and computer to show video
- Regular thread
- Conductive thread
- Coin cell batteries (3V)
- Coin cell holders
- LilyPad LEDs
- Felt
- Fabric glue
- Self-Assessments

Procedure

- Introduction to Sewing
- Sewing practice
- Decide on a design
- Create wearable electronic textiles
- Self-assessment

8. Students should pause after every few stitches to check for loose or tangled threads. They should check both the front and back of the felt to make sure there aren't any tangles, knots, or wrinkles.

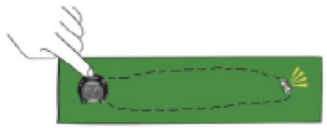


9. Once they reach the LED, have them make at least 3 tight loops around its (+) tab in the same way they attached the battery holder.

10. They can tie a knot to complete this trace. Have them make sure their knot is on the back side of the felt so it won't obscure their design.

11. Instruct the students to repeat the same steps as above to sew the (-) side of the battery holder to the (-) side of the LED. Remind them not to let the (-) trace touch or come close to the (+) trace while they're sewing. They should also beware of loose ends or knots.

12. Students should test the circuit to make sure it is complete. Have them slide the coin cell battery into the holder with the (+) side of the battery face up as they put it in. Then have them flip the switch on the holder from off to on to test it out. Hopefully it lights up! They should keep troubleshooting if it doesn't.



Sewing Note

Students will want to avoid the knots and wrinkles shown in the images to the left. Have them check their work carefully after every stitch to ensure you are keeping the thread and fabric smooth.

INVENTOR PROFILE

Limor Fried is an MIT alumna who turned her passion for tinkering with electronics into a highly profitable business called Adafruit Industries. Would you want to turn any of your hobbies into a business?

Read more about Limor here: Inventor Profile: Limor Fried.

Source: wired.com

JV LEMELSON-MIT InvenTeams

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Microcontrollers for JV InvenTeams Arduino and code as a tool of invention

Rolling Robots Outreach InvenTeam
Rolling Hills Estates, California

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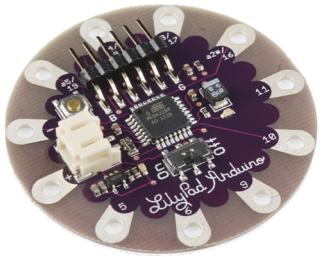
Arduino Hardware

Arduino
UNO



Lilypad Arduino is made to sewable. It is a great addition to your electronic textile projects.

Arduino is open source so many others make identical products. Elegoo is reliable and low cost. You can find these boards for about $12

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Arduino Software

IDE is a free download.
https://www.arduino.cc/en/Main/Software

Simple editor, easy to use.

May need to add USB drivers.
https://www.ftdichip.com/Drivers/VCP.htm

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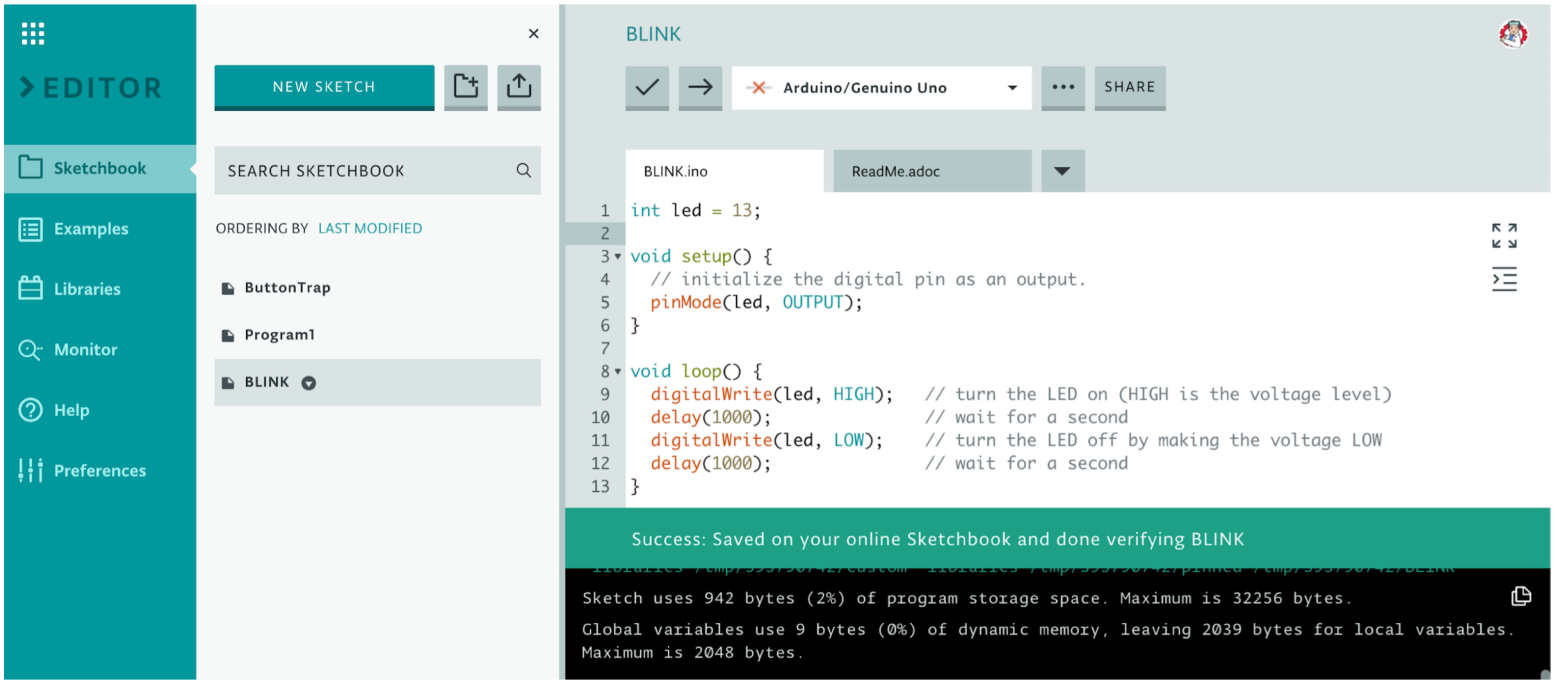
“NEW” Browser Based IDE



https://create.arduino.cc/editor

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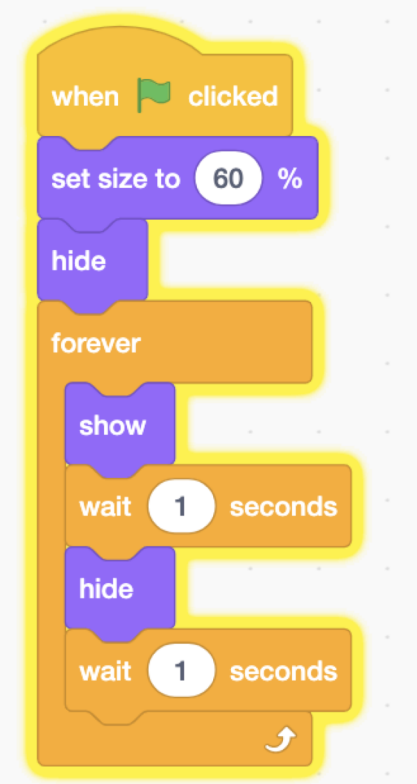
Intro to CODE

C structured language

Great place to start

Easy transition for students that have experience with Scratch



Scratch

```
int led = 13;

void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH);   // turn the LED on
  delay(1000);               // wait for a second
  digitalWrite(led, LOW);    // turn the LED off
  delay(1000);               // wait for a second
}
```

Arduino

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Sensors and Peripheral Devices

Push Button

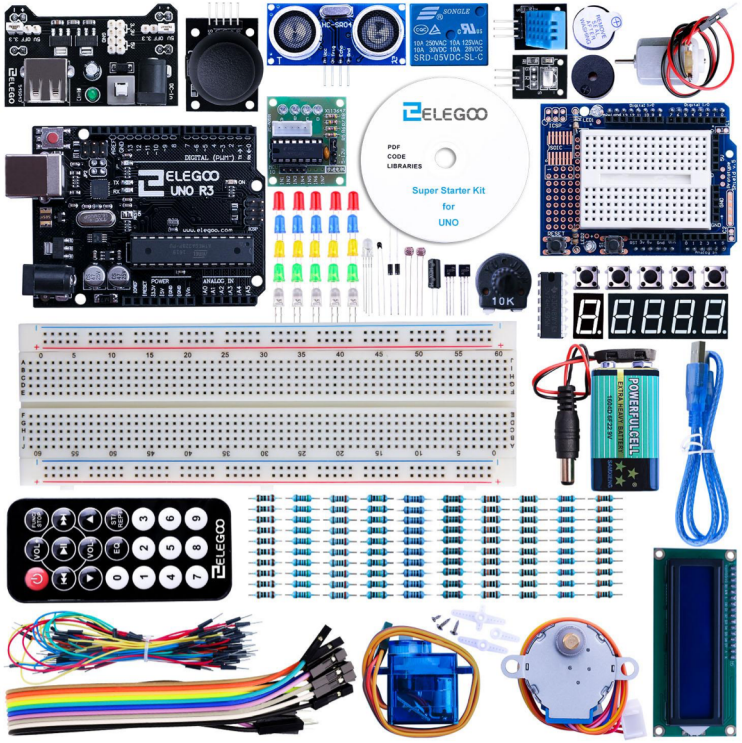
LEDs

Temperature Sensor

Relay

Servo Motor, Stepper Motor

LCD Screen



Elegoo Super
Kit
About $35

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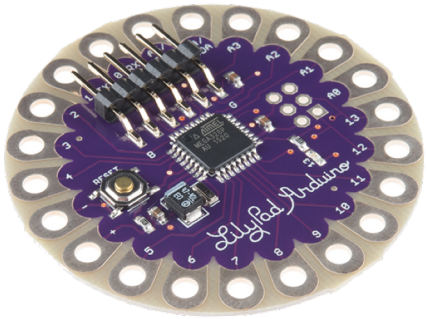
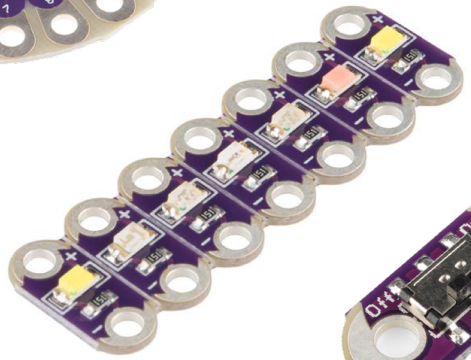
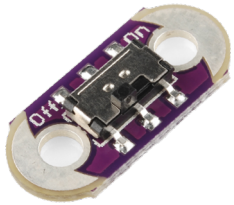
LilyPad Wearable Arduino



Arduino

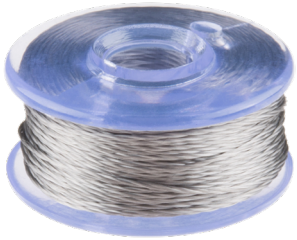


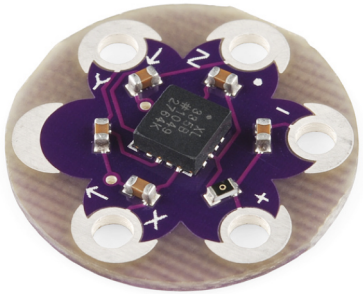
LEDs



Switch

Sewable with Conductive Thread





Accelerometer

Light Sensor

Sensor Details

Digital Output

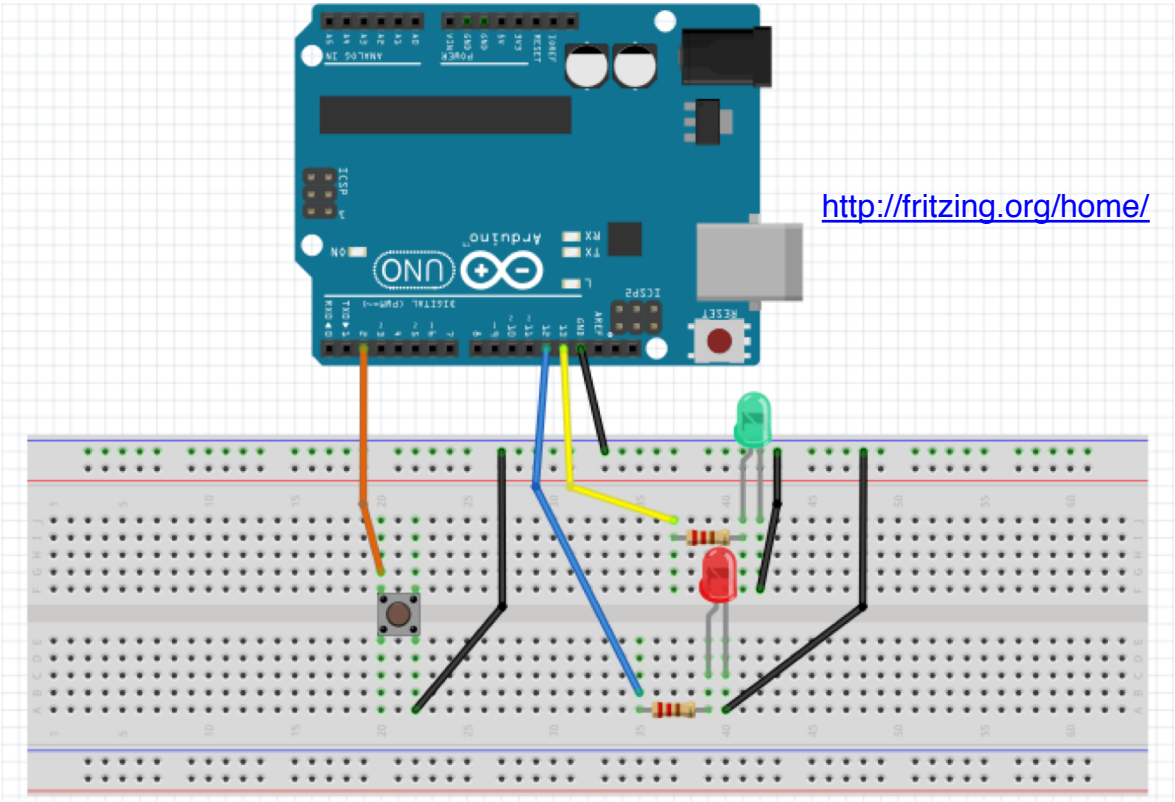
Digital Input

Serial output

Analog Input

Logic

Calculations



http://fritzing.org/home/

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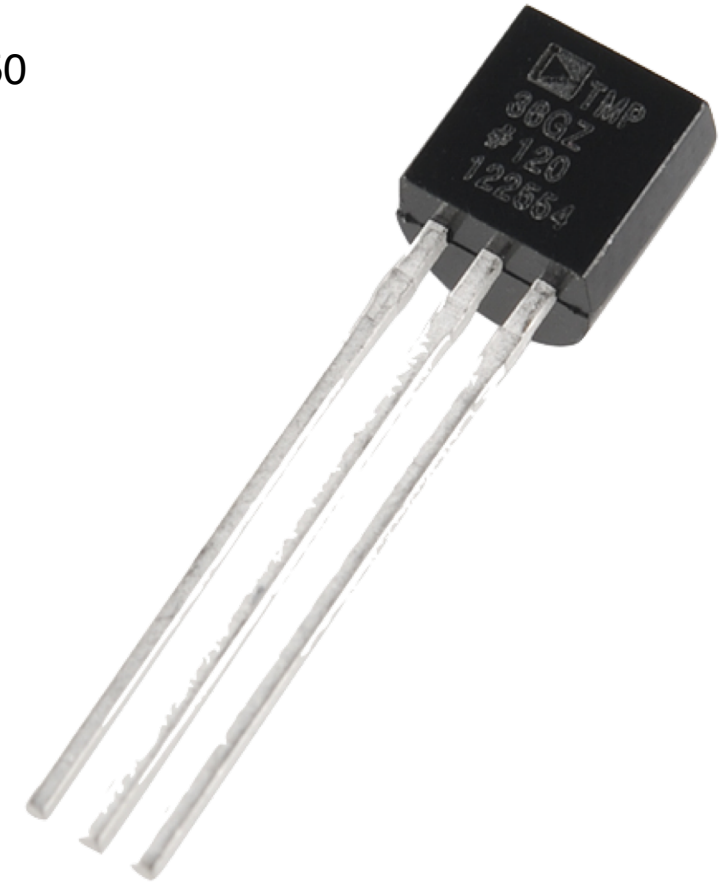
Temperature Sensor

TMP36 https://www.sparkfun.com/products/10988 $1.50

Analog output proportional to Temperature

Temp in degree C = mV / 20

Create an equation to take the analog output of Arduino to temperature. Learn math with integers and floats.



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LCD Display

Display text and variable values

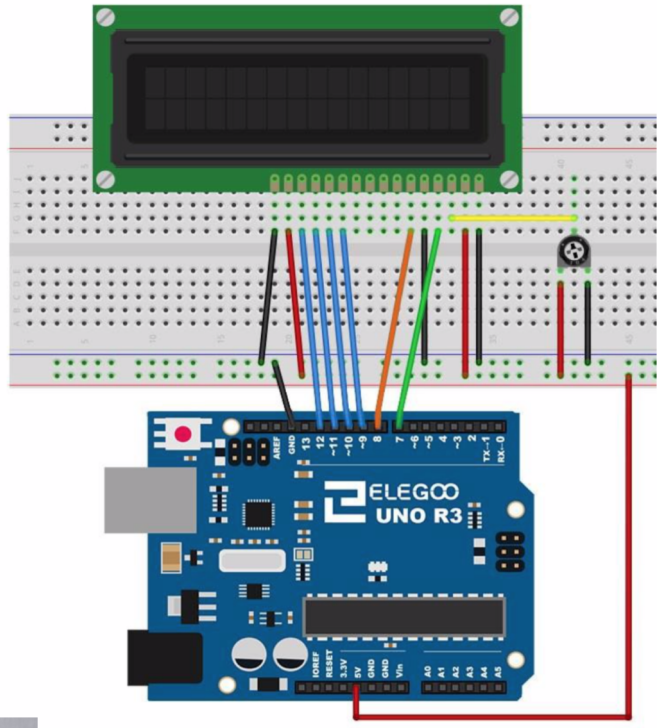
Code Library from ELEGOO

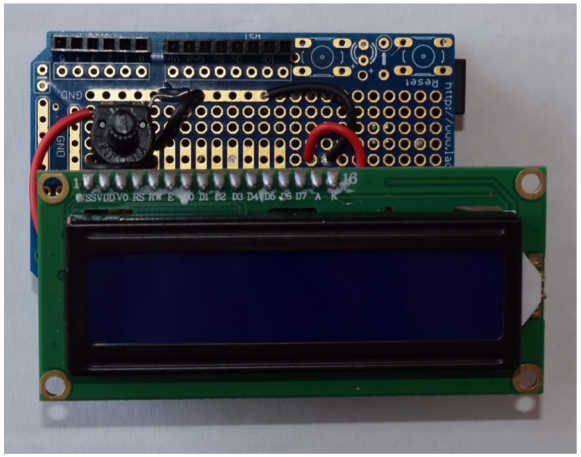
Learn :

How LCD works

Data transfer

Advanced Solder a Shield





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SD Card Data Storage

Continuously log data

Learn data storage

Computer Architecture

https://www.adafruit.com/product/1141 $14

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Integration with JVInvenTeam Guides

Temperature Sensor
Data Logging
Penguins
Pot in Pot Cooler
Refrigerated Lunch Box

LilyPad Arduino
LED Lights
Button Switch
Accelerometer

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Refrigerator Code Example

```
#include <LiquidCrystal.h>
int T = 60;
int Up = 3;
int Down = 2;
float temp = 0.0;
const int tPin = A0;
const int cool=4;
const int rs = 7, en = 8, d4 = 9, d5 = 10, d6 = 11, d7 = 12;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

float Temp(int pin)
{
  return ((analogRead(pin) * (5000.0 / 1023.0)-500)/20 );
}

void AC (float target, int pin, int cool)
{
  float tmp;
  tmp = Temp(pin);
  if (tmp > target)
  {
    digitalWrite(cool, HIGH);
  }
  else if (tmp<= target)
  {
    digitalWrite(cool, LOW);
  }

}
```

```
void setup() {
  Serial.begin(9600);
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  // Print a message to the LCD.
  lcd.print("Set Point = ");
  pinMode(Up, INPUT);
  pinMode(Down, INPUT);
}

void loop() {
  // set the cursor to column 0, line 1
  // (note: line 1 is the second row, since counting begins with 0):
  lcd.setCursor(0, 0);
  lcd.clear();
  lcd.print("Set Point = ");
  lcd.print(T);

  if (digitalRead(Up) == 0)
  {
    T++;
  }
  else if (digitalRead(Down) == 0)
  {
    T--;
  }
  while (digitalRead(Up) || digitalRead(Down))
  {
    delay(10);   // wait for button release
  }
  temp = Temp(tPin);
  lcd.setCursor(0, 2);
  lcd.print("temperature = ");
  lcd.print(temp);
  Serial.println(temp);
  lcd.print("temperature = ");
  AC(T, tPin, cool);
  delay(100);
}
```

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Additional Resources

George's lessons and discussion:
https://stem.rollingrobots.com/

Arduino Reference: https://www.arduino.cc/

Sources for specialty sensors and all electronics. Good tutorials on all products:

https://www.adafruit.com/
https://www.sparkfun.com/

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Opportunities to Work Together & Document Approaches

- Willing to participate in meetings in each CA region
- Willing to host webinars on topics of interest
- Contact Stephanie Couch to be a development partner for our “Making and Coding for a Purpose” initiative
- Register for the Lemelson-MIT Program’s workshop in Tustin California, July 22-24 & MIT, July 29-31 http://lemelson.mit.edu/events
- Consider Partners in Invention (brochure) membership

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Playful Invention Company

Paula Bontá and Brian Silverman are the Playful Invention Company (PICO)

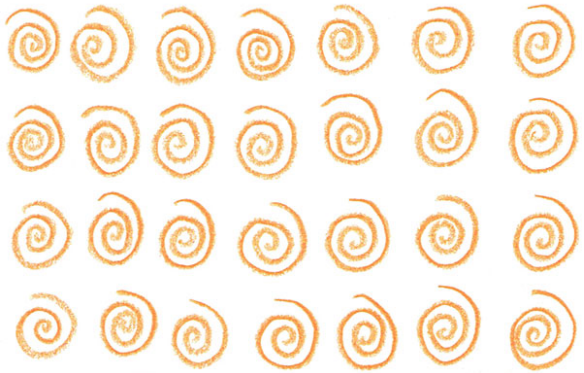
- Based in Montreal and collaborate with people all over the world
- Co-founder Paula Bontá contributed to the design of several award-winning products for children and is a consultant for the Lifelong Kindergarten group at the MIT Media Lab, and for LEGO.
- Brian Silverman has been involved in the invention of learning environments for children since the 1970s. Consulting scientist at MIT Media Lab.

PICO Projects

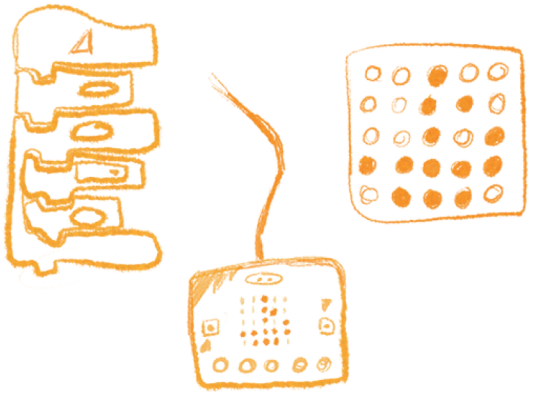
Playful Invention Company

ScratchJr: Intro Programming language for children age 5-7

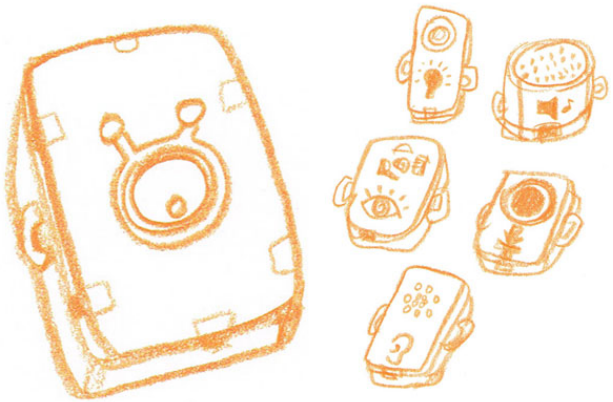
TurtleArt: Design images while exploring geometry and programming



Art: bit: Teaches the basics of programming and animation



PicoCricket Kit: Integrates art and technology to spark creative thinking



- **MIT App Inventor** is an intuitive, visual programming environment that allows everyone – even children – to build fully functional apps for smartphones and tablets.
- Those new to MIT App Inventor can have a simple first app up and running in less than 30 minutes.
- Learn more and try MIT App Inventor at http://appinventor.mit.edu

Projects and Programs

Support Local Change

- SCRIPT - resources and process to aid school systems and local education agencies in strategic planning for CS education
- CS Visions - research project to define the values that drive K-12 CS adoption
- Office Hours - CSforALL members can schedule opportunities to receive consultation and support
- Supporting NYC CS4ALL - CSforALL grew out of CSNYC and still supports the NYC CS4ALL programs and implementation

Projects and Programs

Increase Rigor and Equity

- Pledges to support CS Education - CSforALL helps move the community forward by calling on school and district leaders in the United States to commit to expanding CS access to all students.
- RPPforCS - CSforALL leads a working group of currently funded NSF Research Practice Partnerships focused on CS education.
- Knowledge Forum - convening of researchers to define and address key issues in K-12 CS education.
- Home4CS - NSF funded project to identify opportunities for schools of education to increase their capacity to prepare teachers to teach computer science.
- Expanding Computing Education Pathways - NSF funded Alliance that seeks to increase the number and diversity of students in K-16 computing and computing-intensive degrees by promoting state-level computer science education reform.
- CSforALL and Out of School Time - Work with out of school time educators and programs to identify opportunities to include computer science education and participate in the CSforALL community.

Projects and Programs

Grow the Movement

- CSforALL Membership - the directory for the national CSforALL community, with more than 500 members representing 40 states and nearly 200 content providers
- CSforALL Summit - annual convening to mark progress on the national CSforALL movement. Salt Lake City, Utah, Oct 21-23, 2019
- Community Calls - monthly open calls that feature the work of CSforALL members and address topics of common concern
- CSforALL Slack - communication platform for CSforALL members
- Social media - Twitter and Facebook engagement of the general public

Open Discussion and Q&A