Keynote SciTinyML Latam
Agenda for day (the optimistic alternative)

- Who am I
- What is Arduino
- Sharing models
- 5 neat projects

- The IoT paradigm
- Edge computing
- Moore's law != good enough comp

- What is Arduino Pro
- Idea - prototype - production
- Maker Pro
- The production checklist
- 4 cases

- Components' shortage
- Bootstrapping dylemma
- Zero coding, but where
- TinyML, but here
- Legal matters
- Community management
Special Issue on Open Source Machinery and Laboratory Instrument using the Arduino Software and Hardware Ecosystem

June 2022

Since its creation in 2005, Arduino has impacted our thinking around open tools and digital education. Arduino continues to inspire students and professionals in a spectrum covering from embedded to embodied technology. The principles behind the Arduino ecosystem (open software, hardware, and documentation) offer a platform perspective to the creation of digital devices, as well as SDKs, IDEs, Cloud services, and alternative ways of learning. Our society values, more than ever, open tools for the advancement of science, technology, and economy. This HardwareX special issue will highlight open projects, at the service of society, emerging from the Arduino ecosystem.

Guest editors:

Dr. David Cuartielles, Malmo University, IoTAP research group, Interaction Design, Co-founder of Arduino, david.cuartielles@mau.se
Who am I?
What is Arduino?
void setup() {
    pinMode(13, OUTPUT);
}

void loop() {
    digitalWrite(13, HIGH);
    delay(1000);
    digitalWrite(13, LOW);
    delay(1000);
}
Philosophy 101: Sharing is caring

- Free vs Open Source vs Creative Commons
- Openness implies:
  - Allowing others to profit from your work
  - Performing housekeeping (clean the materials)
  - Documenting your project properly
  - Making uncomfortable decisions on what stays and goes
  - Responding to PRs, issues and bugs in a reasonable time
- Openness is perceived by some as just a marketing tool
Knowing all of that ... would you do it again?
YES! EVERY SINGLE STEP ... IT HAS BEEN A GREAT RIDE!
Sharing is caring: the good stuff

● We have **helped shaping the current model** for hardware licensing

● Openness implies:
  ○ **Profiting from the work of others**
  ○ Enabling unthinkable collaborations
  ○ Lifelong learning (from the community)
  ○ Resilience when confronting large issues
  ○ Friendships for life

● Openness is **perceived** by most as a **brave move**
5 neat projects
What is Arduino Pro?
import pyb  # Import module for board related functions
import sensor, image, time

sensor.reset()
sensor.set_pixformat(sensor.GRAYSCALE)
sensor.set_framesize(sensor.VGA)
sensor.skip_frames(time = 2000)

thresholds = (180, 255)
ledRed = pyb.LED(1)
ledGreen = pyb.LED(2)
ledBlue = pyb.LED(3)

clock = time.clock()

while(True):
    clock.tick()
    img = sensor.snapshot()

    # Find blobs
    blobs = img.find_blobs([thresholds], area_threshold=200, merge=False)

    # Draw blobs
    for blob in blobs:
        img.draw_rectangle(blob.rect(), color=255)
        img.draw_cross(blob.cx(), blob.cy(), color=255)

    # Toggle LEDs
    if len(blobs) > 0:
        ledGreen.on()
        ledRed.on()
    else:
        ledGreen.off()
        ledRed.off()
    time.sleep(50)

print(clock.fps())
Nicla Vision

Speed up deployment of machine vision at the edge
Idea - prototype - product
There is different prototyping cultures

- A prototype is the **illustration of** some of the **features** of an idea
- Designers, engineers, and product managers have **different views** of what a prototype could be
- A prototype can be anything: from a post-it representing the screen of a device, to a release candidate of a piece of hardware almost ready to be launched
- What matters is to **set the level of expectations** right
Products are good to go

... or aren't they?

- According to researchers of the Spanish Center for Research (CSIC) end users have got used to have products which are not finalised
- It is now normal to have devices which functionality varies over time, which software is not final or even capped
- While making hardware upgrades in consumer electronics has been hard for quite a while, OTA software is nowadays a very common thing. From cars to thermostats, we have seen many products come with hidden features, ready to be unblocked for some money more
Nest Thermostat Teardown

Introduction

Awhile ago I read about Nest, a newfangled thermostat with a color display and some interesting ‘learning’ techniques for keeping your home warmed or cooled, as sensible as possible. Did I mention the beast has IR proximity, PIR movement, humidity, magneto scroll, and a mini USB connector? Oh. It does.

Although I failed to capture them on the camera, there was two flexible PCB antennas in a vertical configuration. One antenna was marked ‘Zigbee’. Now this has my interest piqued. I assumed there was just antennas for better reception, but perhaps one antenna is WiFi and one antenna is for something else? Zigbee? No way. Really? Could Nest be planning on adding other equipment control such as lighting or refrigeration? After using the Nest and its accompanying website, I certainly hope so.

The Electronic Bits

With the RF shield removed, we can finally see what lies within.

It’s kind of awesome, but it comes at a price. Pre-orders were $249 + shipping but I’m a sucker for new technology so I got in line. A few weeks after I placed my pre-order I got a piece of spam email from Nest offering a free professional installation. That’s great, but I was not planning on my Nest ever seeing the light of day – I wanted to take it apart and see how it worked. So on a whim, I replied to the email.

Here’s what we were waiting for. This is an astronomical amount of silicon for a thermostat!
But all' this' gonna change with the current trends and regulatory changes around the right to repair
Maker Pro
A [not so new] view about business

- A **maker** is a **contemporary artisan**, with knowledge in digital fabrication techniques, electronics, interactive technologies, etc.

- **Maker Pro** is a term that showed up in the mid 2010’s to name those people who were interested in **pursuing a professional career** out of those skills

- One of the new emerging professions is the **Creative Technologist**, a person with technology and design skills, a hacker looking for bootstrapping or demoing new ideas
Why Does Airbus Have A Makerspace?

By Alvaro Jara Rodelgo

March 8th, 2019

Why Airbus shows interest in the maker movement? As a multinational high end technology company, we may think that all aeronautical innovations require very complex processes and so the make it yourself approach does not fit. This is only partially true. Yes, most of the developments have a high degree of complexity. However, this does [..]

TAPPING INTO FEARLESS CREATIVITY: STORIES FROM THE ADIDAS MAKERLAB

June 6, 2017

From IT to materials and design, a multitude of departments across adidas are challenging themselves in dedicated creative spaces.
The production checklist
Making products is easy (the simple version)

... sending them out is hard

- Conceptualise your idea, put it in words
- Test paper prototypes with potential users
- Make implementation prototypes of core features
- Supply chain: check the life of your parts
- Perform design for manufacturing, talk to the people running the machines
- Supply chain: plan production schedules, book times (also for the lab)
- Make a test run

- Prepare user manual & datasheet, send to certification
- Find committed beta-testers
- Work with the firmware & software
- Design packaging
- Plan distribution at all levels
- Create marketing campaign
- Make a lot of parts
- Profit
Examples of products
Solución Industrial basada en Open Source Hardware

Arduino Leonardo - 20 E/S Controlador Lógico Programable

Solución Industrial basada en Open Source Hardware

Arduino Mega - Gama Ethernet de Controladores Lógicos Programables

Soluciones industriales con placas originales Arduino

¿Necesitas automatizar, monitorear o controlar?
Hazlo con el PLC Arduino

Un controlador industrial programable de Arduino para todo tipo de proyectos.
...y basado en hardware de código abierto!

El primer equipo basado en la tecnología de Arduino diseñado para uso profesional.
Monitoreo, Control y Automatización.

Dre libre de crear tu propia aplicación y ser también el dueño de tu solución.

- Seguridad y robustez. Hasta 58 entradas y salidas
- Placas Arduino siempre originales.
- Protocolos Industriales
  RS232, RS485, USB, IP, Modbus, Ethernet, Full-Half Duplex

MIRA LA GAMA DE PRODUCTOS >>

Hasta 58 Entradas y Salidas
Digital, Analógico y Relé

Protocolos Estándar
  IEC, Modbus, Ethernet, USB, Full-Half Duplex, RS485,
  RS232, USB, Modbus

Sin costes de software
Programable con Arduino IDE

 AUTOMÁTICA INDUSTRIAL BASADA EN ARDUINO

Automatización industrial basada en hardware de código abierto.

AUTOMÁTICA MODULAR
Este autómata basado en Arduino (Open Source Hardware) está especialmente diseñado para su uso en un entorno profesional. Este autómata dispone de hasta 58 entradas/salidas, también dispone de diferentes sistemas de comunicación lo que le ofrece una gran flexibilidad y control. El PLC M.O.T.H.O ofrece la posibilidad de expandir con 127 módulos mediante el sistema IEC, lo que significa que puede gobernar hasta 7100 E/S en un modo máximo usable, además de módulos adicionales de sensores, etc.

Software de Programación
Se puede programar con la actual Arduino IDE platform.

Conexión y codificación instantánea
El PLC ARDUINO se puede programar a través del puerto USB. También se puede configurar el autómata para ser programado de forma remota mediante el puerto Ethernet. Esto ofrece acceso inmediato a la programación, mantenimiento y control. También permite la utilización del Monitor (en el Arduino IDE) para ver el estado de todas las variables, entradas, salidas, etc. Este equipo es totalmente compatible con Arduino y Arduino IDE de forma instantánea lo que le ofrece una solución industrial completa.
Airports clearly give security the utmost importance: stringent rules must be rigidly followed – but also quickly updated as needed, without creating vulnerabilities.

Stockholm-based company RIOT Secure was founded to address the current and potential security issues our world faces, as billions of objects are connected to the Internet and IoT emerges as one of the strongest growing trends of our time. For them, working with SAS (Scandinavian Airlines) Ground Handling provided the ideal high-constraint project to prove security can be embedded at the core of any IoT solution.

In airports, service vehicles are tracked both for billing purposes and to ensure compliance with safety and security protocols – which constantly evolve. For example, geo-fencing boundaries must be checked in real time to avoid anyone entering forbidden zones, and staff must use RFID-based security badges to access and operate the equipment.

Therefore, in designing a new solution, the critical requirement RIOT Secure was asked to meet was to ensure that all network communications were secure, and that firmware updates could be performed over-the-air, instantly and across the entire fleet of vehicles.

“SAS Ground Handling can now ensure their equipment are securely connected to the cloud, and that they can enhance the safety and security protocols implemented at the edge in a matter of seconds.”

AARON ARDIRI, CEO OF RIOT SECURE

OUR SOLUTION

RIOT Secure developed a secure device lifecycle management platform based on Arduino MKR boards, for communications and over-the-air updates specifically targeting resource-constrained microcontrollers.

The industrialized PCB includes at least two microcontrollers: one or more task-focused supporting the safety and security logic and edge processing, while the Arduino MKR provides secure network communication.

The task-focused microcontrollers utilize an AtMega2560 interface via UART to receive GPS positions to check geo-fencing, RFID badge swipes and GPIOs to drive external relays, which control a beacon light and can limit vehicle speed. At the same time, the microcontroller sends and receives data in binary optimized packets, completely independent of the underlying communications technology. When a firmware update is available, it is downloaded and then the appropriate microcontroller is reprogrammed.
The IoT paradigm
The computer of the XXIst century

The Active Badge

This harbinger of inch-scale computers contains a small microprocessor and an infrared transmitter. The badge broadcasts the identity of its wearer and so can trigger automatic doors, automatic telephone forwarding and computer displays customized to each person reading them. The active badge and other networked tiny computers are called tabs.

BATTERIES

CONTROL BUTTON

MICROPROCESSOR

INFRARED LIGHT-EMITTING DIODES

COMPUTER SCRATCHPADS augment the conventional screen in this office at the Xerox Palo Alto Research Center. Prototype pads are wired to conventional computers; thus far only a handful of wireless models have been built.
RADIO TRANSCEIVER links pads and other movable computer devices to the wired network. This unit, intended to be mounted on the ceiling, contains antennas in its crossed arms and two light-emitting diodes to signal its status.
Ubiquitous Computing

Main characteristics

- The computer's purpose should be helping you making other things
- The best computer is a silent and invisible helping tool
- The more tasks you can achieve intuitively, the smarter you will become: the computer should augment your conscious mind
- Technology should create a calm state
Kevin Ashton, 2009

The fact that I was probably the first person to say "Internet of Things" doesn't give me any right to control how others use the phrase. But what I meant, and still mean, is this: Today computers—and, therefore, the Internet—are almost wholly dependent on human beings for information. Nearly all of the roughly 50 petabytes (a petabyte is 1,024 terabytes) of data available on the Internet were first captured and created by human beings—by typing, pressing a record button, taking a digital picture or scanning a bar code. Conventional diagrams of the Internet include servers and routers and so on, but they leave out the most numerous and important routers of all: people. The problem is, people have limited time, attention and accuracy—all of which means they are not very good at capturing data about things in the real world.

And that’s a big deal. We’re physical, and so is our environment. Our economy, society and survival aren’t based on ideas or information—they’re based on things. You can’t eat bits, burn them to stay warm or put them in your gas tank. Ideas and information are important, but things matter much more. Yet today’s information technology is so dependent on data originated by people that our computers know more about ideas than things.

If we had computers that knew everything there was to know about things—using data they gathered without any help from us—we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best.

We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. RFID and sensor technology enable computers to observe, identify and understand the world—without the limitations of human-entered data.
Industry 4.0

Images courtesy of: https://www.i-scoop.eu/industry-4-0/
Industry 4.0 (4th Industrial Revolution)

Main characteristics

- Bigger levels of automation
- Industrial IoT and digital twins
- Migration of centralised control mechanisms to others where the products themselves define the manufacturing process
- Data models and closed-loop control systems
- Personalisation of the end products
Edge computing: the opportunity
Demonstrator:
Recognition of handwritten digits on an Arduino UNO

www.aifes.de
Have we found any good cases of edge computing or are we still just scratching the surface of what it could do?
From a pedagogical perspective, have we figured out the best way to achieve transdisciplinary outreach?
Moore’s law under the microscope or good enough computing
Do we really need even faster computers to execute more complex tasks? Or complexity just needs to be properly programmed?
Challenges
Supply chain: problems started with Fukushima, followed by the pandemic, the war, and a demand increase of 26% y2y.
The nominal reason given was that the machine used to set the frequency of the chips was broken or otherwise unavailable, and due to supply chain problems it couldn’t be fixed anytime soon. Thus, we had to go to the factory to get the parts. But, in order to order direct from the factory, we had to order 18,000 pieces minimum — over 9x of what I needed. Recall that one wafer yields 58,000 chips, so this isn’t even half a wafer’s worth of oscillators. That being said, 18,000 chips would be about $12,000. This isn’t chump change for a project operating on a fixed budget. It’s expensive enough that I considered recertification of the product to use a different oscillator, if it weren’t for the degradation in standby time.
Bootstrapping dilemma: making up to a certain amount can be handled directly by the maker, who will assume part of the cost
The creators of the PINE A64, a Raspberry Pi-esque single board computer, which demolished its $31,416 Kickstarter funding goal, raising a whopping $1.7 million, have received abuse and death threats — with one person even showing up at the company’s office, threatening to kill staff if he didn’t receive his $22 board — over minor delivery delays.

In an e-mail to Kickstarter backers, PINE64 co-founder Johnson Jeng revealed that the company has, understandably, been overwhelmed by the sheer number of orders and that the demand has put a strain on production and shipping.

Hey Guys,

I’m going to try and explain this as easy as possible in laymen terms so everyone can TRY to understand. Those that understand, thank you for understanding and those that do not... well, we’re very sorry.

First things first. When we set out to build a single board computer at $15-$28, we were set out to create a community of developers and help bring a $15 computer to the masses (note that it costs us $15 to make them), to be introduced to education, developers, innovators, and more. From a simple sub $50,000 goal to create our first batch of boards and with a mental preparation that we will probably sell no more than 5000-10,000 boards, became a campaign that sold over 45,000 boards collectively in less than 50 days. Now, what does this mean? We had put a February/ March / April delivery date because we know that we are able to deliver our expected amount, and to date, we have shipped over 10,000 boards. Now to delay issues..
Zero coding: sure it works, but where will you apply it? Devices? Ecosystems? And which paradigm? Blocks? Wizards?
Advanced ML for every solution

Edge Impulse is the leading development platform for machine learning on edge devices, free for developers and trusted by enterprises.

Get started Schedule a demo
“The new Arduino Braccio ++”

by David Cuartielles
Legal ...
Legal ... stuff
Legal aspects to consider

- **Certification**: you want your design to be compliant with whatever regulations exist for that specific category of product and to pass the tests established by the authorities for it not to hurt living beings, not interfere with other devices, etc.

- **Protection**: even open designs require protection, since there is a certain degree of brand dilution through counterfeit actions

- Too simple not to be copied
Certification

- New devices need to pass a certification process, software changes might
- This can be carried by specific labs, a government, etc. depending on the country
- The main markets that many other countries accept for being among the most restrictive are the one in the US (FCC) and the one in the EU (CE)
- Japan has its own special law just to regulate any radio communicating device. This is the reason why some products are sold with deactivated WiFi and leaving up for the end user to activate it
- E.g. Mexico has recently changed its own regulatory frameworks and currently demands passing their own certification
This work aims to analyze the effect of unauthorized use of trademarks on its consumer-based brand equity and on the consumer purchase decision, through a mediation model with structural equations. An experiment was carried out with 618 participants, who were exposed to advertising of famous brand products or senior brands, and fictitious products with the same brands or junior brands. Participants were then asked to make some purchases with a real budget of US$5. The results show that exposure to junior brands reduces senior brand equity, i.e. results in trademark dilution, mediating a reduction in the purchase of senior brand products. In addition, similarity between junior and senior brands alleviates brand equity dilution, while consumer involvement with the product category of the famous brand has no moderating effect. The study aims to contribute to our understanding of trademark dilution, including the effect on purchase decision – a subject so far unexplored in the empirical literature. Moreover, the study pursues to highlight the importance of protecting well-known trademarks in order to avoid damage occurring not only in consumer perceptions, but also in firm’s sales and brand financial value.

Keywords:
- Trademark dilution
- Blurring
- Brand equity
- Purchase decision
- Well-known trademarks
Community management and platforms

- Community management should not be based just on expecting people's good will for things to just work
- Currently there are professionals dedicated to handle these activities
- There is a plethora of platforms that responds to the needs of different types of communities, you have to choose wisely how to get people engaged
- Remember that some people will need to be trained in the use of platforms and that you might be interested in hiring some members of your community because of their skills
Wrapping up
Yo people ... it’s Q&A time!