TWinGo

Theremino Windows Go

The cheapest and precise robot arm STEM, hobbist and DIY for desktop application

最便宜且精确的机械臂 STEM、业余爱好者和 DIY 桌面应用

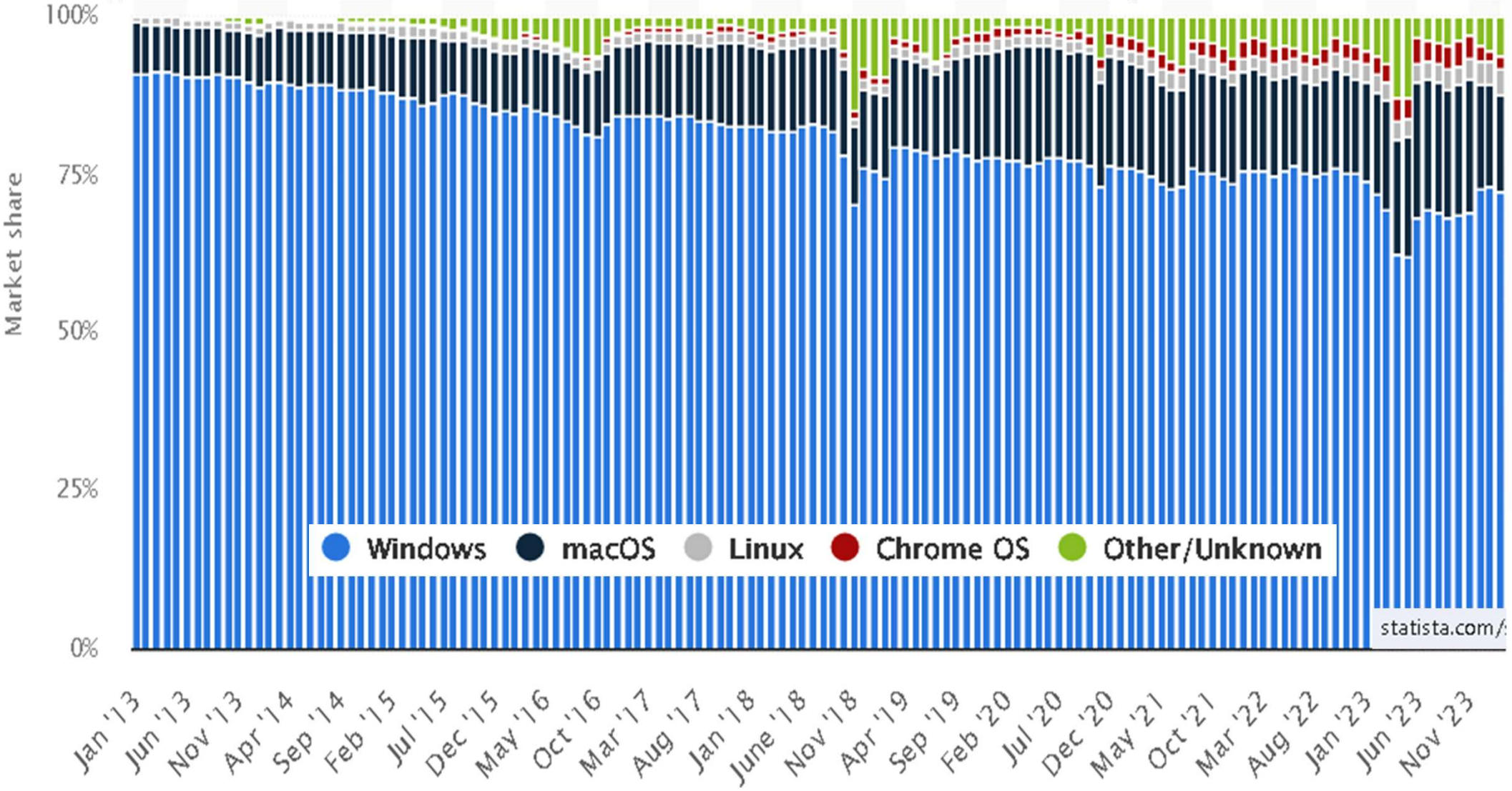
www.theremino.org

深圳市宝安区航城大道航城创新创业园A2栋1-2楼

创新的 **Theremino** 系统。
优点和好处。
我们使用**WINDOWS**技术。

The innovative Theremino System.
Advantages and benefits.
We use WINDOWS technology.

我们为什么投资 Windows？ 答案很简单。
Why we invest in Windows? Answer is easy.



Windows 操作系统是最广泛、最知名的操作系统。。

The Windows operating system is the most widespread and well-known of all.

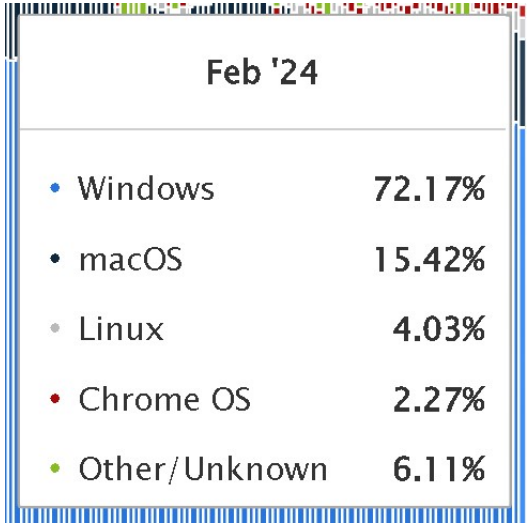
采用Win10系统
We use Windows 10

- **Windows** 是有史以来最常用的操作系统。
- 搭载了现代处理器的 **Windows** 系统，能够以很快的速度执行程序，足以替代 **LINUX / ROS** 来驱动 **COBOT (**工业协作机器人**)**。

Windows is the most used operating system ever.

With the modern processors available, the execution speed of the programs is high, this speed is more than enough to drive COBOTs as an alternative to LINUX / ROS.

我们让机器人自动化变得简单
Windows is know by everyone.



TWinGo is an educational robotic arm designed to work exclusively with the Windows operating system.

This strategic choice offers numerous advantages for learning:

Familiarity and ease of use:

Windows is the most popular operating system in the world, with an intuitive interface that most students are already familiar with.

By eliminating the need to learn a new operating system, TWinGo allows students to focus on learning robotics right away.

TWinGo 是一款教育机器人手臂，专门设计用于 **Windows** 操作系统。

这种战略选择为学习提供了许多优势：

熟悉度和易用性：

Windows 是世界上最流行的操作系统，其直观的界面为大多数学生所熟悉。

通过消除学习新操作系统的需要，**TWinGo** 使学生能够立即专注于学习机器人技术。

我们让机器人自动化变得简单
Windows is know by everyone.

Safety and reliability:

Windows offers a high level of security and reliability, which is essential for use in educational contexts.

TWinGo integrates several security features for a safe and risk-free learning experience.

TWinGo: the ideal choice for learning robotics

Combining simplicity, familiarity and a wide range of resources, TWinGo stands as the ideal choice for learning robotics in school and home contexts.

With its unique compatibility with Windows, TWinGo breaks down barriers to access and makes learning robotics an engaging and accessible experience for everyone.

安全可靠：

Windows 提供高水平的安全性和可靠性，这对于教育环境中的使用至关重要。

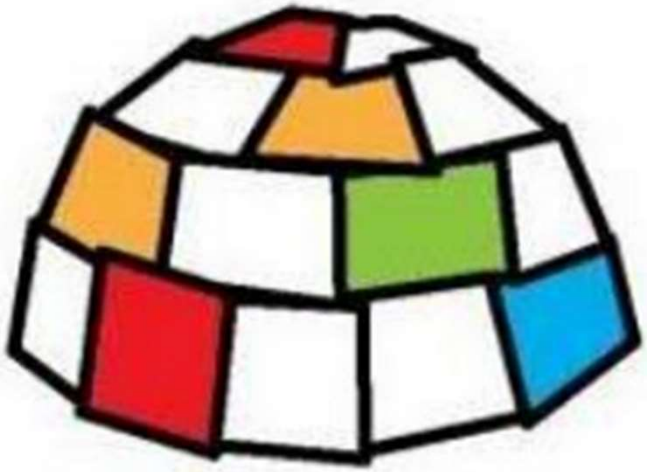
TWinGo 集成了多种安全功能，可提供安全、无风险的学习体验。

TWinGo：学习机器人技术的理想选择

TWinGo 结合了简单性、熟悉性和广泛的资源，是在学校和家庭环境中学习机器人技术的理想选择。

凭借其与 **Windows** 的独特兼容性，**TWinGo** 打破了访问障碍，使学习机器人成为每个人都参与且易于访问的体验。

我们让机器人自动化变得简单
Windows is know by everyone.



theremino
·the·real·modular·in-out·

TWinGo: three development environments for unprecedented flexibility

TWinGo is an educational robotic arm designed to offer a complete and flexible learning experience.

At the base of TWinGo is the Theremino System, an open source platform that offers three distinct development environments:

THEREMINO BLOCKLY

THEREMINO AUTOMATION

WINDOWS VISUAL STUDIO (Express Edition, that are free for non-professional use)

TWinGo：三种开发环境提供前所未有的灵活性

TWinGo 是一款教育机械臂，旨在提供完整且灵活的学习体验。

TWinGo 的基础是 **Theremino** 系统，这是一个开源平台，提供三种不同的开发环境：

Theremino 块

Theremino 自动化

WINDOWS VISUAL STUDIO（快捷版，非专业人士免费使用）

我们让机器人自动化变得简单
THEREMINO BLOCKLY

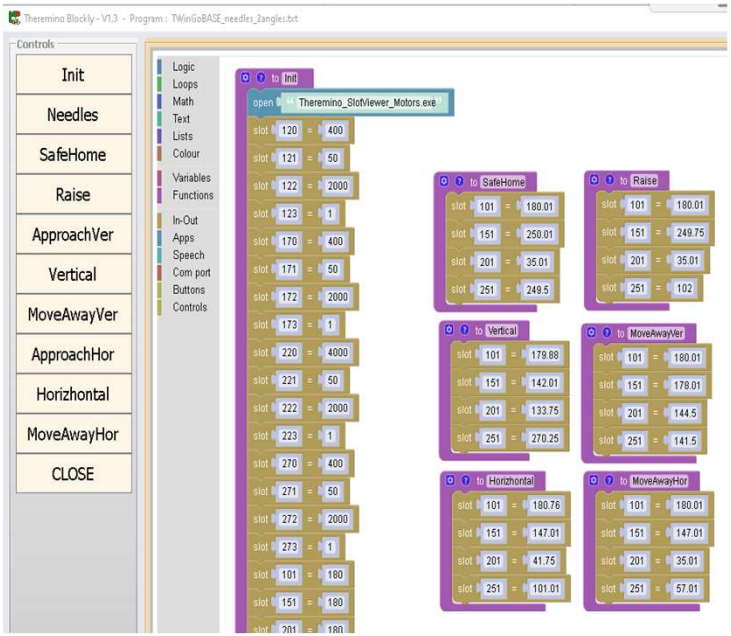
WinGo: Theremino Blockly for safe and intuitive learning

Theremino Blockly is the ideal development environment for beginners who want to approach robotics with TWinGo in a safe and fun way.

Offline Security:

Unlike the original Google version, Theremino Blockly does not require an internet connection, ensuring safe and secure learning.

Running the software locally makes TWinGo up to 10,000 times faster, providing a smooth and responsive programming experience.



WinGo：Theremino Blockly 用于安全直观的学习

Theremino Blockly 是对于想要以安全有趣的方式使用 **TWinGo** 学习机器人技术的初学者来说的理想开发环境。

离线安全：

与原始 **Google** 版本不同，**Theremino Blockly** 不需要互联网连接，确保安全可靠的学习 。

在本地运行该软件使 **TWinGo** 的速度提高了 **10,000** 倍，提供流畅且响应迅速的编程体验。

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THEREMINO BLOCKLY

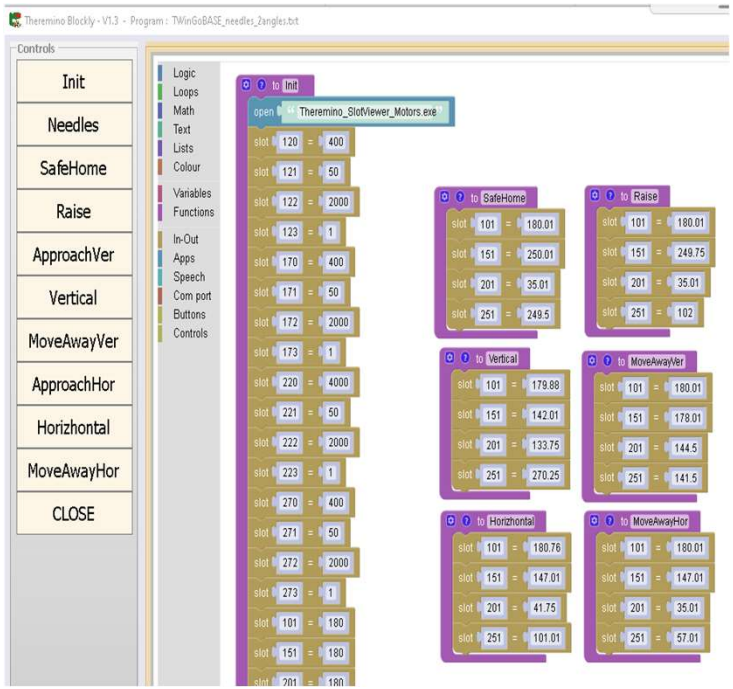
Blockly Google
A Visual Programming Language

Intuitive block interface:

Theremino Blockly uses a visual block interface that makes programming the robot simple and accessible even to novice students.

Predefined code blocks can be combined to create complex programs, without the need to write lines of code.

The front end with slots makes programming even simpler and more intuitive, making it easier to understand the process of creating a program.



直观的块界面：

Theremino Blockly 使用可视化块界面，使机器人编程变得简单，甚至对于新手学生来说也易于使用。

可以组合预定义的代码块来创建复杂的程序，而无需编写代码行。

带插槽的前端使编程更加简单直观，更容易理解创建程序的过程。

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Gradual and creative learning:

Theremino Blockly allows you to start with simple programs and gradually progress towards the creation of more complex projects.

The development environment encourages experimentation and creativity, encouraging learning through play and discovery.

Advantages of Theremino Blockly for learning:

Security: Protects students from online risks.

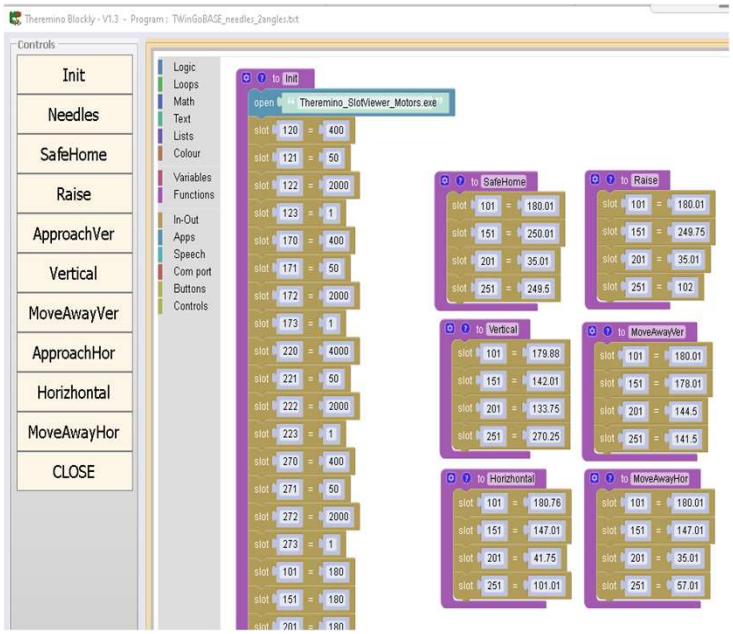
Speed : Provides a smooth and responsive programming experience.

Intuitiveness: Makes programming accessible to everyone.

Flexibility: Allows you to create programs of different complexity.

Creativity: Encourage experimentation and playful learning.

Simplicity: The front end with slots makes programming even easier.



循序渐进和创造性学习：

Theremino Blockly 允许您从简单的程序开始，逐步创建更复杂的项目。

开发环境鼓励实验和创造力，鼓励通过玩耍和发现来学习。

Theremino Blockly 的学习优势：

安全性：保护学生免受在线风险。

速度：提供流畅且响应迅速的编程体验。

直观性：让每个人都能轻松编程。

灵活性：允许您创建不同复杂程度的程序。

创造力：鼓励实验和有趣的学习。

简单性：带有插槽的前端使编程变得更加容易。

我们让机器人自动化变得简单

THEREMINO BLOCKLY

Theremino Blockly: the ideal gateway to the world of educational robotics.

With its intuitive and secure interface, Theremino Blockly makes learning TWinGo robot programming a fun and rewarding experience for all students.

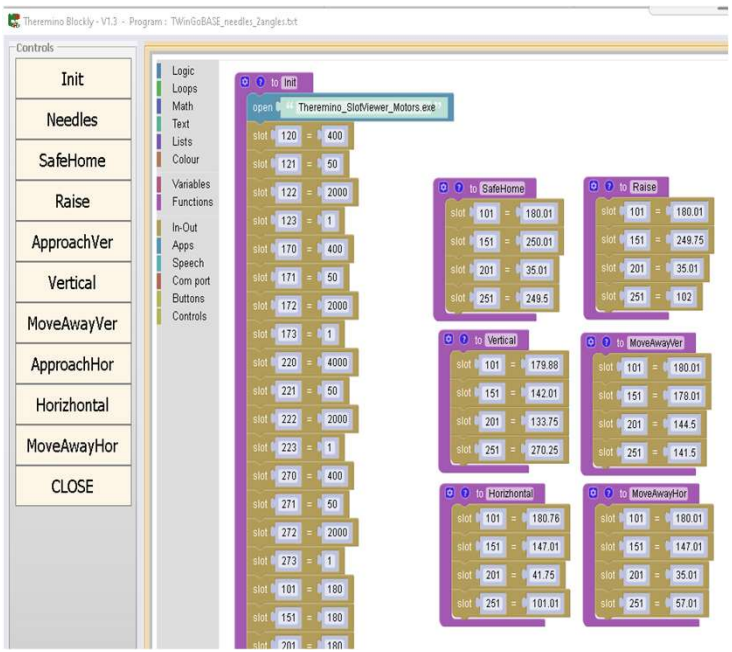
Here are some examples of how you can rephrase the concept into more concise and engaging sentences:

TWinGo: learn robotics in a safe and fun way with Theremino Blockly.

TWinGo: block programming for everyone, even the little ones.

TWinGo: develop your creativity with Theremino Blockly.

TWinGo: the future of educational robotics begins with Theremino Blockly.



Theremino Blockly：通往教育机器人世界的理想门户。

凭借其直观且安全的界面，**Theremino Blockly** 使学习 **TWinGo** 机器人编程成为所有学生的有趣且有益的体验。

以下是一些如何将概念改写为更简洁、更吸引人的句子的示例：

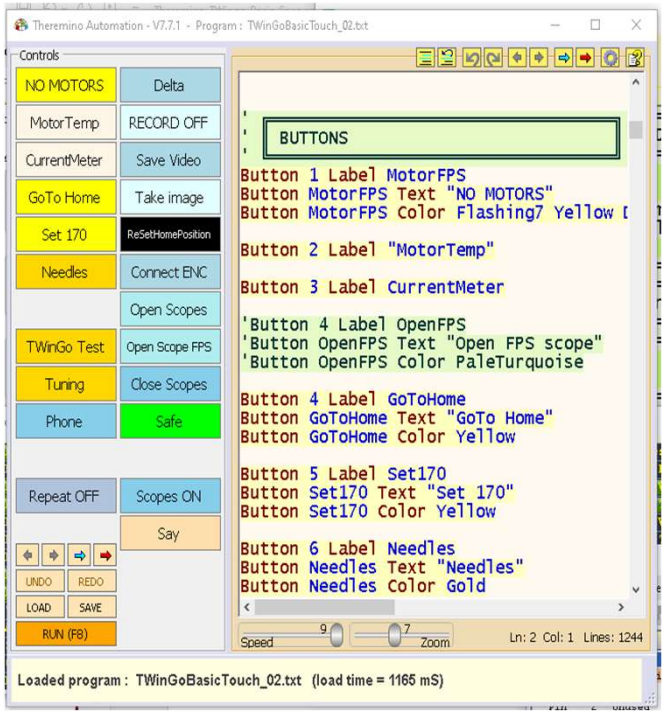
TWinGo：使用 **Theremino Blockly** 以安全且有趣的方式学习机器人技术。

TWinGo：适合每个人的块编程，甚至是小孩。

TWinGo：使用 **Theremino Blockly** 开发您的创造力。

TWinGo：教育机器人的未来始于 **Theremino Blockly**。

Theremino 自动化。
THEREMINO AUTOMATION.

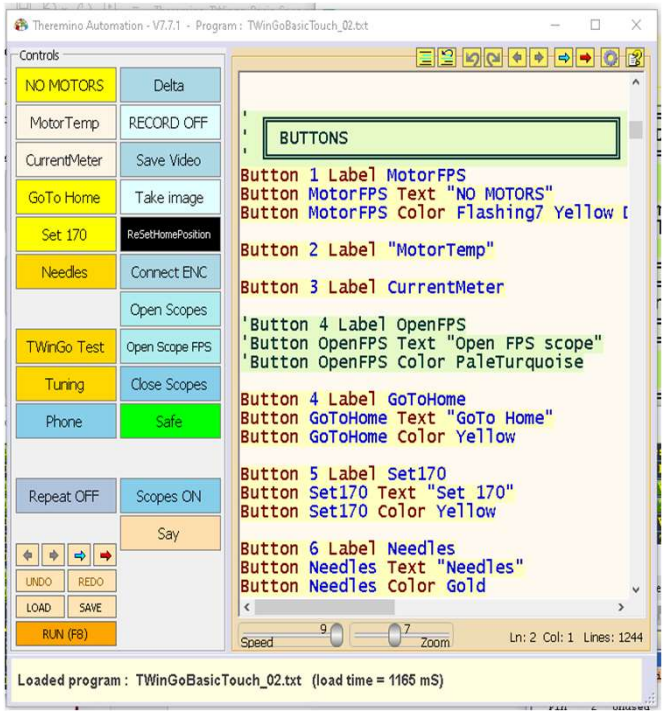


TWinGo: Theremino Automation, the natural evolution for your growth in robotics Theremino Automation represents the next step for users who, after having become familiar with the Blockly language, wish to explore new possibilities and reach a more advanced programming level.

TWinGo：Theremino 自动化，机器人技术发展的自然演变

Theremino 自动化代表了在熟悉 **Blockly** 语言后希望探索新的可能性并达到更高级的编程水平的用户的下一步。

Theremino 自动化。
THEREMINO AUTOMATION.



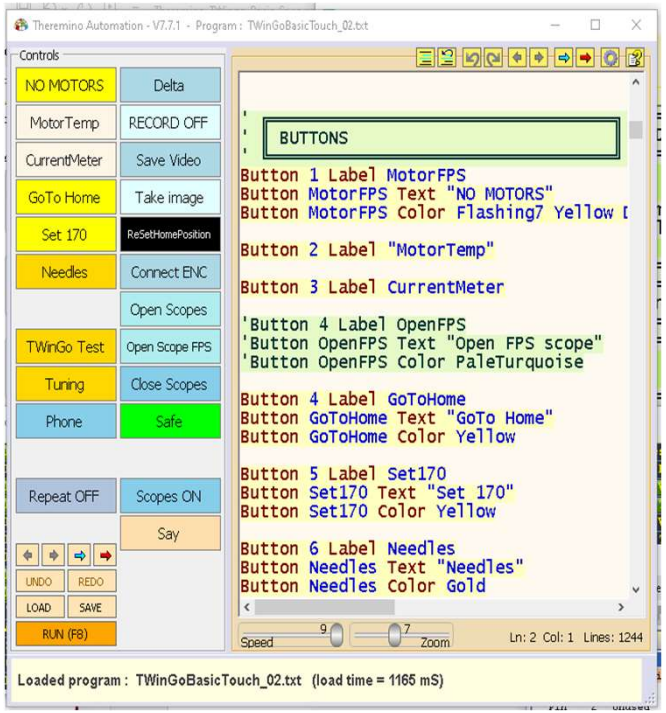
Pushing the limits:
Theremino Automation offers greater freedom and flexibility than Blockly, allowing you to create complex and customized programs.
The structure of the language, similar to BASIC but with notable simplifications, facilitates the transition from Blockly and makes learning gradual and intuitive.

突破极限：

Theremino Automation 提供比 **Blockly** 更大的自由度和灵活性，允许您创建复杂和定制的程序。

该语言的结构与 **BASIC** 类似，但具有显着的简化，有助于从 **Blockly** 进行过渡，并使学习渐进且直观。

Theremino 自动化。
THEREMINO AUTOMATION.



Enhance your creativity:

With Theremino Automation, the control of the TWinGo robot becomes complete and precise, allowing you to create innovative and ambitious robotics projects.

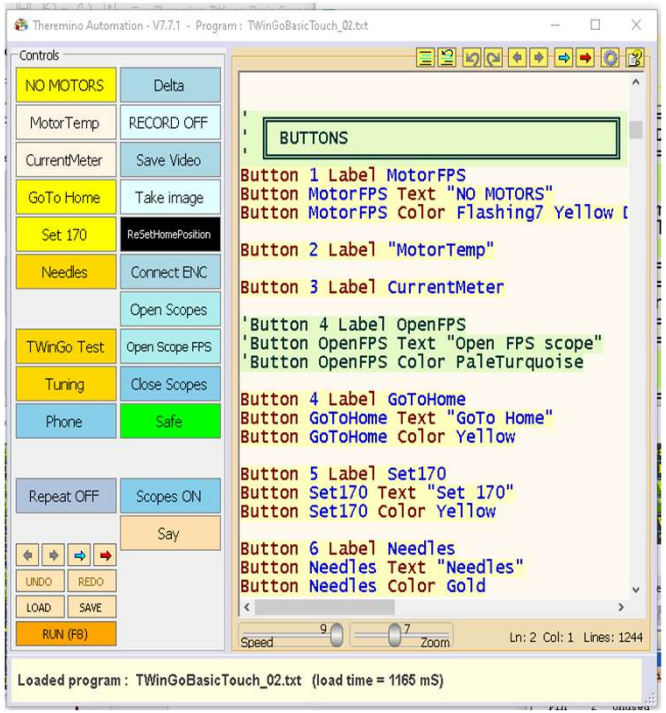
The vast range of predefined libraries and functions, combined with the ability to write custom code, open up a world of limitless creative possibilities.

增强你的创造力：

借助 **Theremino Automation**，**TWinGo** 机器人的控制变得完整且精确，使您能够创建创新且雄心勃勃的机器人项目。

大量的预定义库和函数，再加上编写自定义代码的能力，打开了一个充满无限创意可能性的世界。

Theremino 自动化。
THEREMINO AUTOMATION.



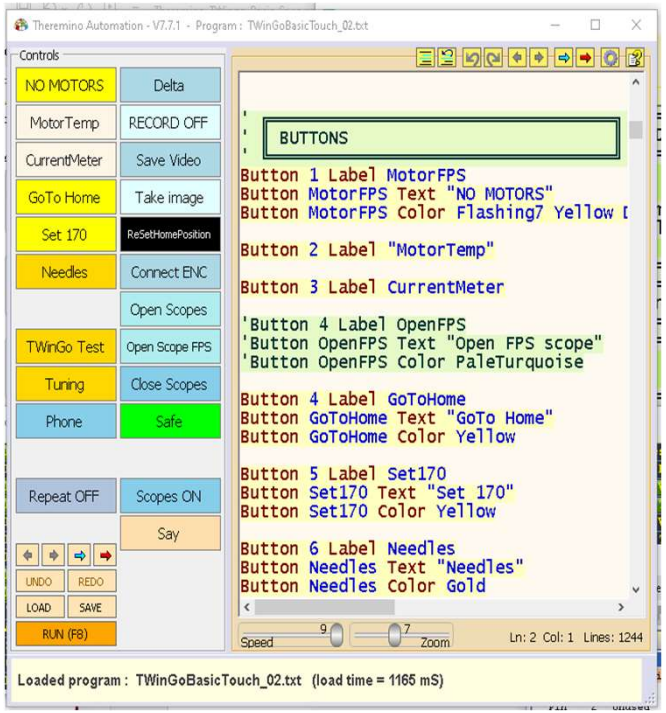
Expand your knowledge:
Theremino Automation represents an opportunity to deepen your computer science knowledge and become familiar with advanced programming concepts.
The gradual learning curve and the rich documentation available will accompany you on your growth path, allowing you to overcome your limits and reach new goals.

扩展你的知识：

Theremino 自动化提供了加深您的计算机科学知识并熟悉高级编程概念的机会。

循序渐进的学习曲线和丰富的可用文档将伴随您的成长道路，让您克服自己的局限性并实现新的目标。

Theremino 自动化。
THEREMINO AUTOMATION.v



Why Theremino Automation:
Greater freedom and flexibility: Create complex, customized programs.
Complete Control: Manage the TWinGo robot with precision and accuracy.
Creative Potential: Express your creativity with endless possibilities.

Advanced Learning: Take on new challenges and expand your computer science knowledge.
Theremino Automation: the key to unlocking your full potential in robotics.
Take a step forward in your growth and discover a new level of freedom and control with Theremino Automation.

为什么 **Theremino** 自动化：
更大的自由度和灵活性：创建复杂的定制程序。
完全控制：精确、准确地管理 **TWinGo** 机器人。
创意潜力：以无限的可能性表达您的创造力。
高级学习：接受新的挑战并扩展您的计算机科学知识。
Theremino 自动化：释放机器人技术全部潜力的关键。
通过 **Theremino** 自动化，在您的成长中向前迈出一步，并发现自由和控制的新水平。

Visual Studio 与 Theremino 系统的界面
Visual Studio interface with Theremino System

TWinGo: Unlock the power of advanced programming with Microsoft Visual Studio
TWinGo takes your robot programming experience to a whole new level with Microsoft Visual Studio integration.
What is Visual Studio?
Visual Studio is a complete and versatile integrated development environment (IDE), widely used by professional developers around the world. It offers a wide range of features to create and manage complex software projects.

TWinGo：使用 **Microsoft Visual Studio** 释放高级编程的力量

TWinGo 通过 **Microsoft Visual Studio** 集成将您的机器人编程体验提升到一个全新的水平。

什么是 **Visual Studio**？

Visual Studio 是一个完整且多功能的集成开发环境 **(IDE)**，被世界各地的专业开发人员广泛使用。 它提供了广泛的功能来创建和管理复杂的软件项目。

Visual Studio 与 Theremino 系统的界面
Visual Studio interface with Theremino System

Why Visual Studio with TWinGo?

Unmatched power and control: Visual Studio puts advanced tools for writing, debugging and managing code at your disposal, allowing you to create extremely complex and high-performance robotics programs.

Unlimited Flexibility: Leverage the power of various programming languages supported by Visual Studio, such as C++, C#, and Python, to fully customize your TWinGo robot to fit your needs.

为什么选择 **Visual Studio** 与 **TWinGo**？

无与伦比的功能和控制：**Visual Studio** 提供了用于编写、调试和管理代码的高级工具供您使用，使您能够创建极其复杂和高性能的机器人程序。

无限的灵活性：利用 **Visual Studio** 支持的各种编程语言（例如 **C++**、**C#** 和 **Python**）的强大功能，完全自定义您的 **TWinGo** 机器人以满足您的需求。

Visual Studio 与 Theremino 系统的界面
Visual Studio interface with Theremino System

Simplified collaboration:
Visual Studio is perfect for development teams, making it easy to collaborate and share code between multiple programmers.

Professional Experience:
Visual Studio is the industry standard for software development, giving you the opportunity to learn and use the same tools used by professionals.

简化协作 – **Visual Studio** 非常适合开发团队，让多个程序员之间轻松协作和共享代码。

专业经验：**Visual Studio** 是软件开发的行业标准，让您有机会学习和使用专业人士使用的相同工具。

Visual Studio 与 Theremino 系统的界面
Visual Studio interface with Theremino System

TWinGo with Visual Studio:

The choice of expert programmers

If you're an experienced programmer looking to push your robotics skills to the limit, TWinGo with Visual Studio is the perfect match. Unlock a world of creative possibilities and realize innovative and ambitious robotics projects.

Note: Visual Studio may require more advanced programming skills than Theremino Blockly and Theremino Automation.

TWinGo 与 Visual Studio：专家程序员的选择

如果您是一位经验丰富的程序员，希望将您的机器人技术发挥到极限，那么 **TWinGo** 与 **Visual Studio** 是完美的搭配。 开启充满创意可能性的世界，实现创新且雄心勃勃的机器人项目。

注意：**Visual Studio** 可能需要比 **Theremino Blockly** 和 **Theremino Automation** 更高级的编程技能。

TWinGo编程基本技巧：
Basic skills for programming TWinGo

立即使用 **TWinGo** 机器人的基本技能。

Windows 程序：记事本、**Excel**、**Word** 和网页浏览基础知识。

基础：几何和算术理解。

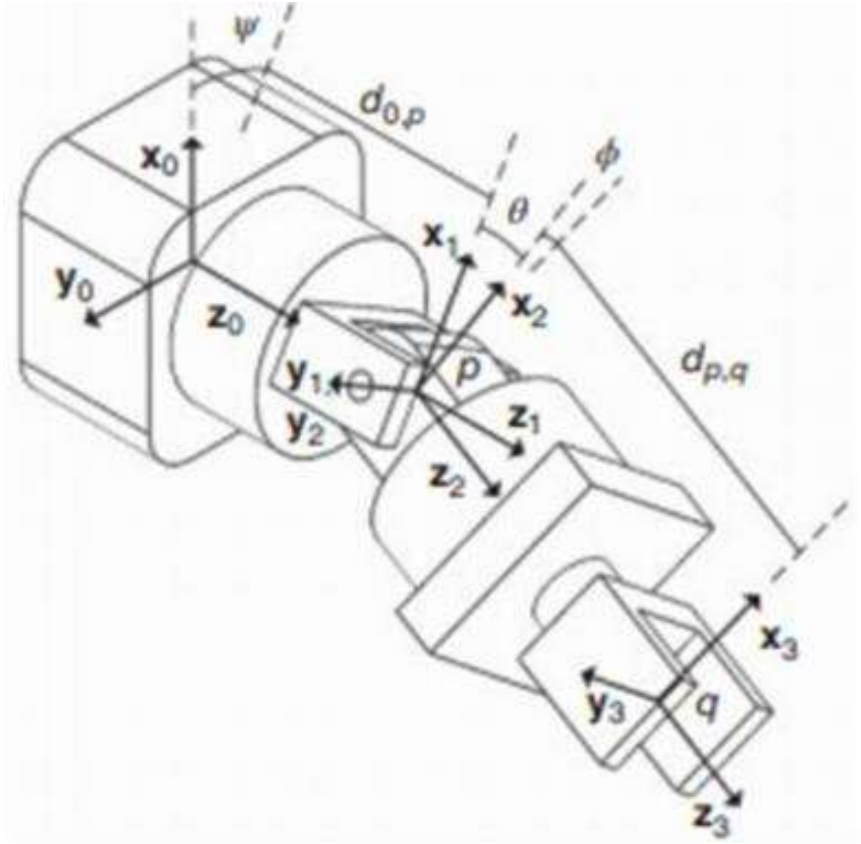
Basic skills to immediately use the TWinGo robot.

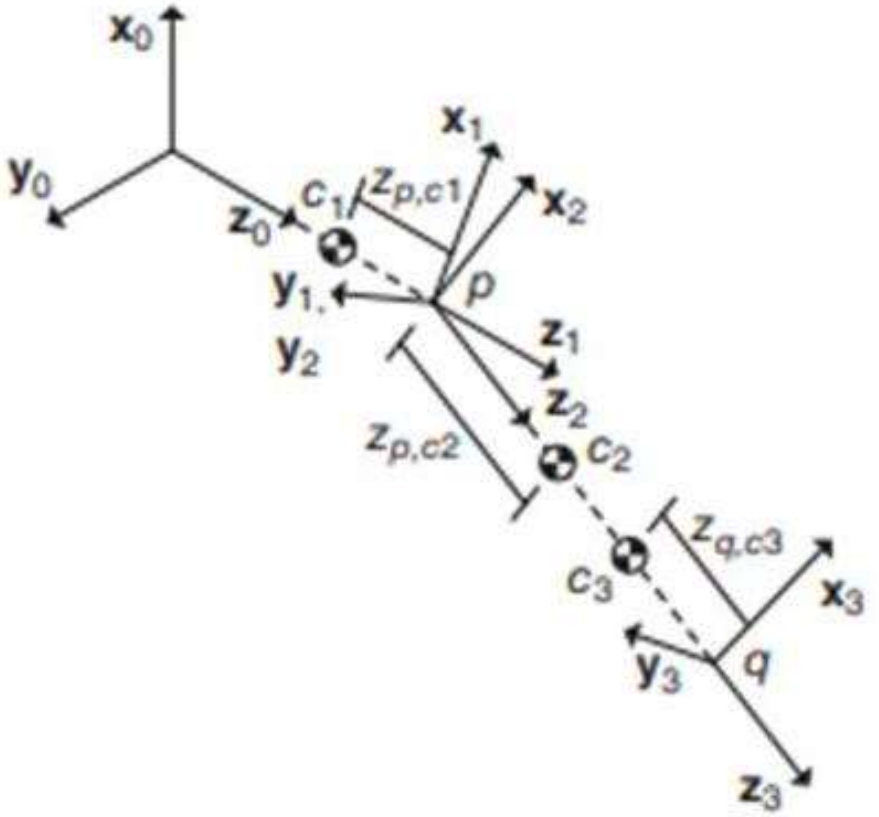
Windows programs: Notepad, Excel, Word, and web browsing basics.

Basic of: geometry and aritmetic understanding.

我们让机器人自动化变得简单

Now, language of automation is for specialized engineers





这种过于复杂的专业技能和知识，还是留给大公司的工程师吧！

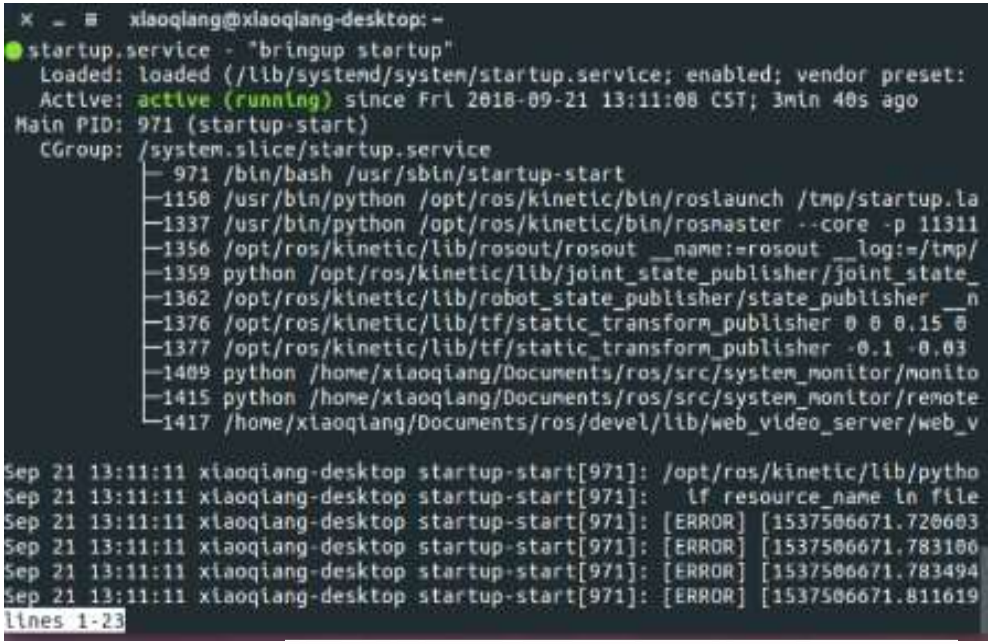
This type of expertise and knowledge, let's reserve it for engineers of large companies.

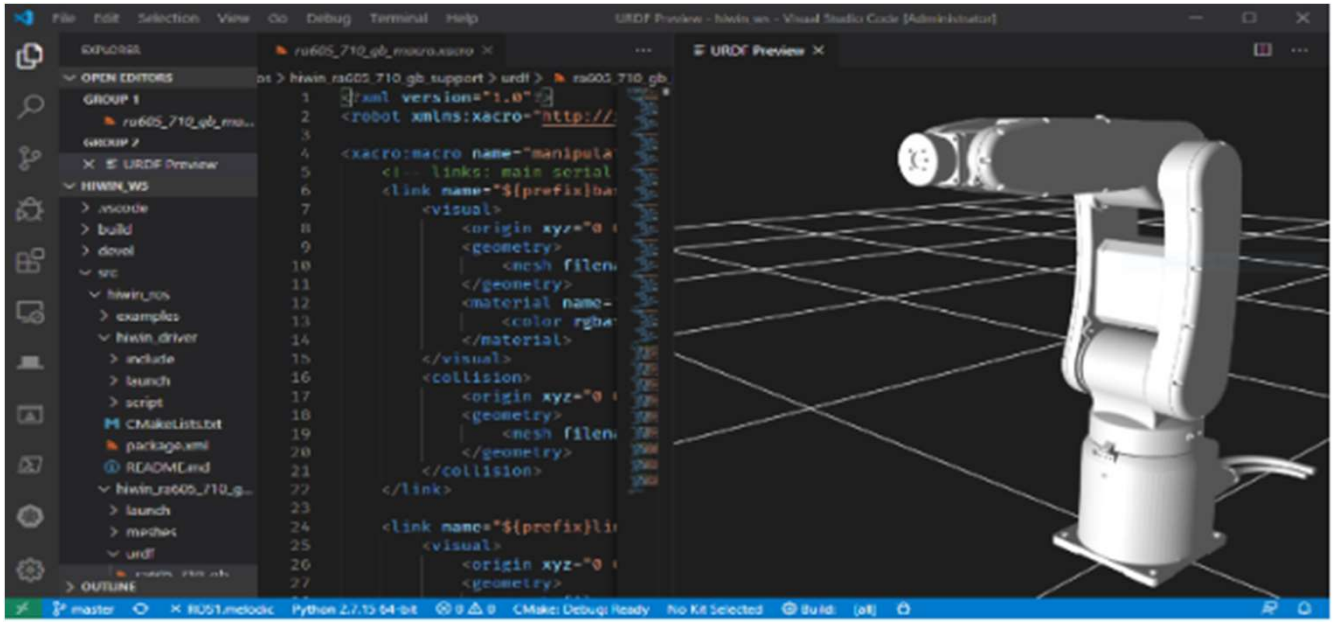
我们让机器人自动化变得简单
Now, language of automation is for specialized engineers

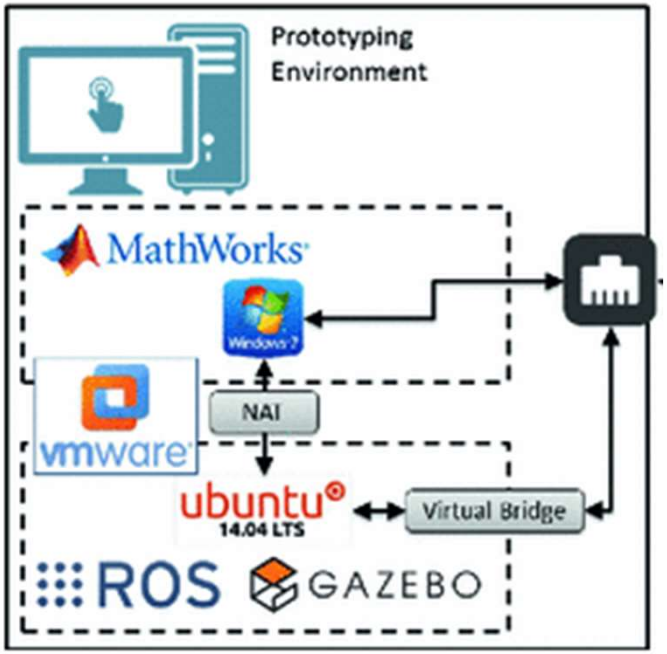
- 只有具有高水平教育、专业知识和经验的工程师才能处理这些软件工具，而且这些软件大多来自美国
- 只有机器人公司的专家知道如何最好地管理他们的机器人

Only engineers with a high level of education, expertise and experience can handle these software tools, mostly of US origin.

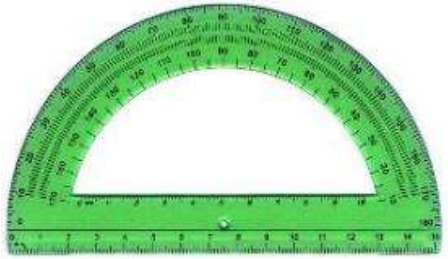
Only the expert of the companies that produce the robots know how to best manage their robots.







我们让机器人自动化变得简单
We make automation with robot simple



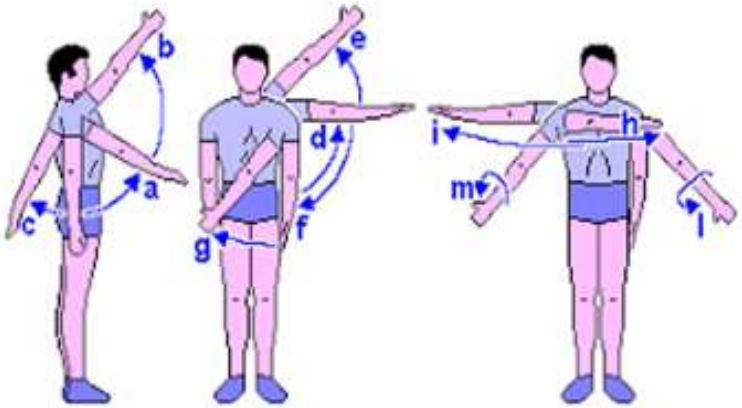
您所需要的只是在学校已经学到的基本几何知识（角度）以及使用 **Windows PC** 的正常经验。

使用 **Theremino**，您的指令会转化为机械臂的真实运动。

All you need is basic geometry knowledge (angles) that you have already learned at school and the normal experience of using a PC with Windows.

With Theremino, your instructions are transformed into real movements of the robotic arm.

我们对 **TWinGo** 使用最简单的概念。
We use simplest concepts for TWinGo.



日常经验都是基于我们手臂和腿的运动，一切都可以追溯到简单的角度。

Theremino 利用这种简单性使每个人都可以使用机器人技术。

使用 **Theremino**，您可以使用与移动身体相同的角坐标对机器人手臂进行编程。这是一种直观、自然的方式让您的机器人焕发活力。

Everyday experience is based on the movement of our arms and legs, and everything can be traced back to simple angles.

Theremino exploits this simplicity to make robotics accessible to everyone.

With Theremino, you can program your robotic arm using the same angular coordinates that you use to move your body.

It's an intuitive and natural way to bring your robot to life.

简单
Simplicity

The recent popularity of cranes in shopping malls proves that no special engineering training is needed to drive a Cartesian robot. You learn by trying and trying again with the satisfaction of immediate feedback.

最近起重机在商场中的流行证明，驱动笛卡尔机器人不需要特殊的工程培训。 你可以通过一次又一次的尝试来学习，并获得即时反馈的满足感。

我们让机器人自动化变得直观
We make process automation intuitive

机器人运动的程序是一个简单地按照列和行分布的文本文件。

列表示要发送到电机的值，行则是发送值的执行命令序列。

当您执行各行的命令序列时，机器人会同步移动。

文本文件中的值均以简单度数表示。

The program for the robot's movement is a simple text file organized by columns and rows.

In the columns there are the values to be sent to the engines and in the rows the sequence of values to be sent.

When you send the row sequences, the robot moves in sync.

The values indicated in the file are expressed in simple degrees.

```
'-----------------------------------
'       M1 Z    M2 IN   M3 OUT  M4 Cup
SendCommand SayW Pick and place of coins begin.
MoveTo +171.42 +250.00 +036.65 +132.49 'Safe pos
MoveTo +216.12 +177.40 +094.00 +266.15 'unlock
MoveTo +216.21 +127.37 +135.00 +188.26 'Approaching to
SendCommand Sayw Coin taking.
MoveTo +216.21 +117.37 +135.00 +188.26 'Pick
SendCommand StartPump
MoveTo +216.21 +127.37 +135.00 +188.26 'Rise small
MoveTo +216.12 +130.57 +155.83 +167.52 'Rise more
MoveTo +216.56 +164.09 +113.12 +215.86 'Rise high
SendCommand Say Move to show the coin slowly.
MoveTo +183.80 +164.05 +098.74 +258.54 'Move to show
MoveTime 3
MoveTo +167.24 +179.52 +076.91 +305.56 'show
SendCommand SayW Coin showed.
MoveSpeed 2000
SendCommand Say Move to the delivery place.
MoveTo +157.50 +169.63 +097.12 +216.30 'Vertical to p
MoveTo +157.50 +151.79 +093.43 +206.28 'Approaching to
MoveTo +157.50 +146.54 +093.43 +206.28 'Place
SendCommand StopPump
SendCommand Sayw Coin placing.
MoveTo +157.50 +154.54 +093.43 +206.28 'Rise small
MoveTo +157.50 +189.35 +100.76 +161.00 'Rise high
MoveTo +180.00 +250.00 +036.00 +150.00 'Safe pos
SendCommand Say Routine end, move to safe position.
SendCommand Sayw  Thanks for watching.
```

我们让机器人自动化变得直观
We make process automation intuitive

```
'-------------------------------------
'       M1 Z     M2 IN    M3 OUT   M4 Cup
SendCommand SayW Pick and place of coins begin.
MoveTo +171.42 +250.00 +036.65 +132.49 'Safe pos
MoveTo +216.12 +177.40 +094.00 +266.15 'unlock
MoveTo +216.21 +127.37 +135.00 +188.26 'Approaching to pick
SendCommand Sayw Coin taking.
MoveTo +216.21 +117.37 +135.00 +188.26 'Pick
SendCommand StartPump
MoveTo +216.21 +127.37 +135.00 +188.26 'Rise small
```

当机器人移动时，当下运行的命令行会实时以蓝色突出显示。

为了便于理解，可以在每行末尾附加注释予以说明。

其他例如启动、关闭真空泵等命令均使用简单的命令语言。

您可以输入命令，这些命令在执行时会以语音提示您正在执行的操作。

As the robot moves, the running line is highlighted in blue in real time.

To facilitate understanding, comments can be written at the end of each line.

Other commands such as starting the vacuum pump and turning it off use simple commands.

You can enter commands that will verbally tell you what operation to do.

我们让机器人自动化变得直观
We make process automation intuitive

```
'-----------------------------------
'        M1 Z     M2 IN    M3 OUT   M4 Cup
SendCommand SayW Pick and place of coins begin.
MoveTo +171.42 +250.00 +036.65 +132.49 'Safe pos
MoveTo +216.12 +177.40 +094.00 +266.15 'unlock
MoveTo +216.21 +127.37 +135.00 +188.26 'Approaching to pick
SendCommand Sayw Coin taking.
MoveTo +216.21 +117.37 +135.00 +188.26 'Pick
SendCommand StartPump
MoveTo +216.21 +127.37 +135.00 +188.26 'Rise small
```

或者，更经济的是，您可以直接使用键盘和鼠标来编辑机器人的位置，以及作用于每个电机的角度值。

Alternatively and much more economically, you can use the keyboard and mouse to edit the position of the robot, acting on the value of the angle of each motor.

TWinGo 基础版
TWinGo BASIC version

TWinGo基础版 - 销售套件
TWinGo BASIC version - sales kit

电源

电源/USB适配器

TWinGo BASIC 机械臂

Power supply

Power / USB adapter

TWinGo BASIC robot arm

TWinGo 电源/USB 适配器
TWinGo COMUNICATION ADAPTER

连接：**USB 2.1**、电源 **7.5 V**、机器人电源/信号插头。

电源开关和 **LED** 电源指示灯。

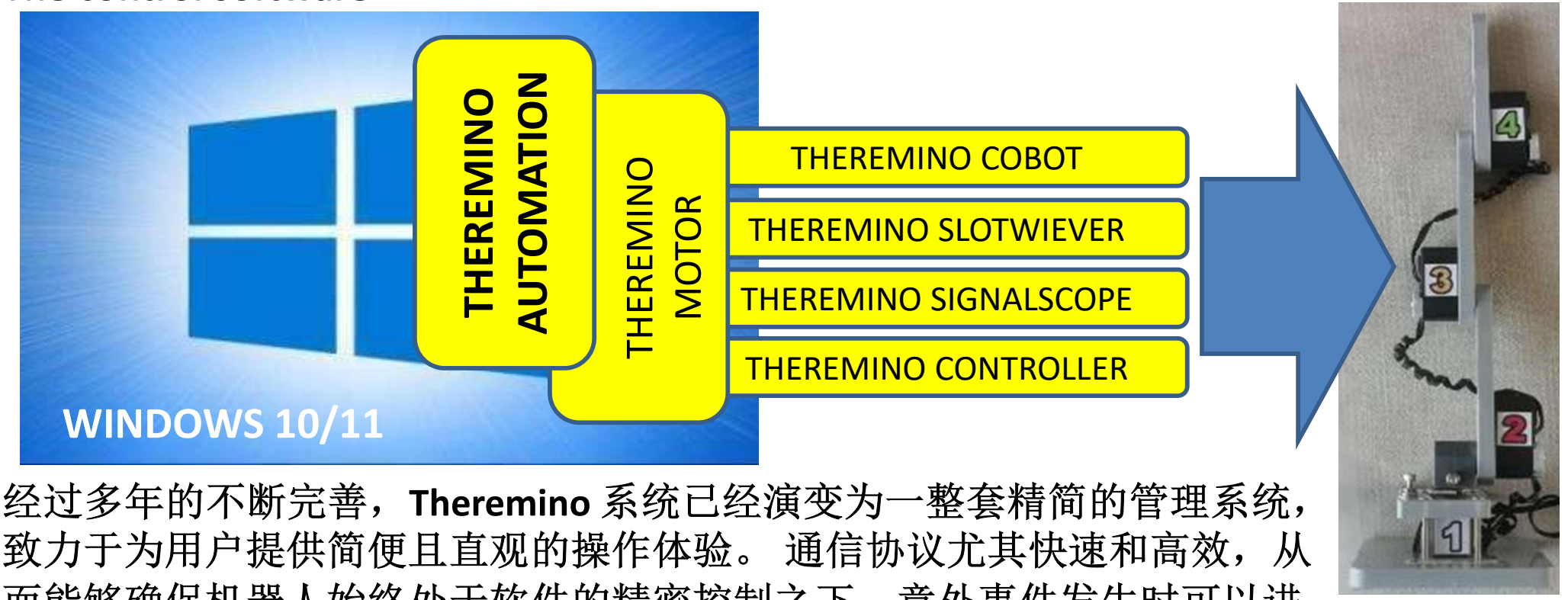
Connections: USB 2.1, Power 7.5 V, plug for power/signal for robot.
Power Switch and LED for power on indicator.

TWinGo基础版 - 销售套件
TWinGo Basic version - sales kit

电源：输入 **110/220V AC**，
输出 **7.5V DC**，**3** 安培，
中央触点正极。

Power Supply: Input 110/220V AC, output 7.5 V DC, 3 Amper. Positive at central contact.

控制软件
The control software



经过多年的不断完善，**Theremino** 系统已经演变为一整套精简的管理系统，致力于为用户提供简便且直观的操作体验。 通信协议尤其快速和高效，从而能够确保机器人始终处于软件的精密控制之下，意外事件发生时可以进行实时干预。 此外，机器人运作安全度高，可以安装于桌面与人类协作，仿佛是我们人类的第三只手一样。

Over the years we have perfected the Theremino System, transforming it into a simplified management system so that the operation for the user is simple and intuitive. The communication protocol is particularly fast and efficient, ensuring that the robot is always under the careful control of the software and can intervene in the event of unexpected events. Furthermore, the system can operate securely for desktop applications by collaborating with humans, as if it were a third hand.

特征
Characteristics

机械臂技术特点

基本的：

旋转：**180°**（**90°**至**270°**）

武器：

内部：长度 **100** 毫米，偏移 **180°**

中：长度 **100** 毫米，偏移 **180°**

外部：长度 **75** 毫米，偏移 **270°**

材料：

臂：**10mm** 防火紧凑型 **PVC**

引擎：

电源：**7.5** 伏，触摸：**19** 公斤/厘米

接线：**3**线，电源，地线，数据信号

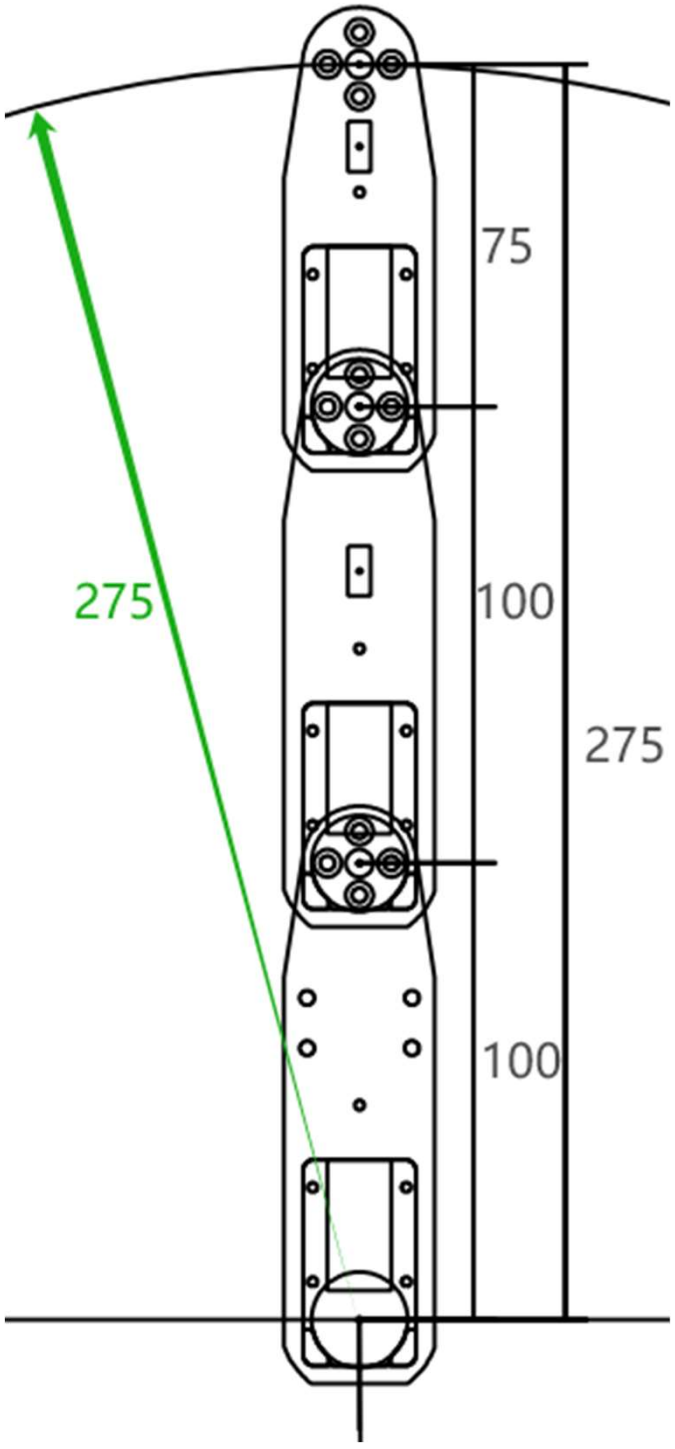
沟通：

速度：**1Mbps**

笔记：

所示的游览行程均为近似值。

请参阅说明手册以获取更准确的信息。



Technical Characteristics of the Robotic Arm

Base: Rotation: 180° (90° to 270°)

Arm Inner: Length 100 mm, Excursion 180°

Arm Middle: Length 100 mm, Excursion 180°

Arm Outer: Length 75 mm, Excursion 270°

Materials: 10mm fireproof compact PVC

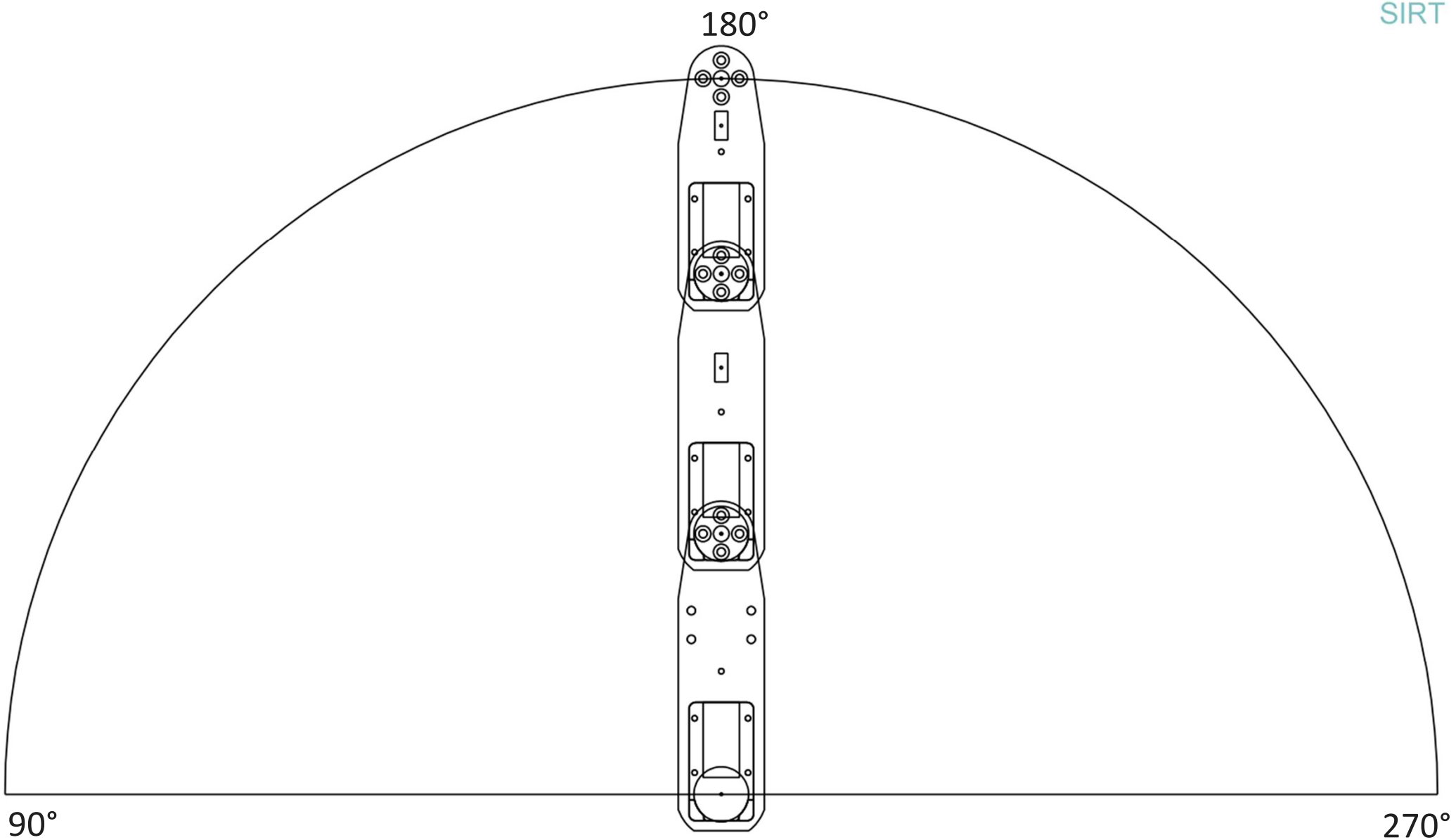
Engines: Power supply: 7.5 Volt

Torque: 19 Kg/cm

Wiring: 3 wires, Power, Ground, Data signal

Communication: Speed: 1Mbps

Note: The excursions indicated are approximate. Consult the instruction manual for more precise information.


180°
90°
270°

特雷米诺双子座：
机器人手臂技术

Theremino TwinGo BASIC:
Technology for a COBOT Robotic Arm

Features and Functions

- Open-source (not all module)
- Modular design for easy customization
- 4 degrees of freedom for precise movement
- Payload capacity of up to 300 grams
- Compatible with a variety of sensors and tools

Applications and Use Cases

- Education and research
- Industrial automation
- Rehabilitation and therapy
- Assistive technology
- Creative arts and entertainment

Benefits and Advantages

- Affordable and accessible
- Easy to learn and use
- Versatile and adaptable
- Safe and reliable
- Supported by a community of users

特性与功能

•开源软件
•模块化设计，易于定制
•4 个自由度，实现精确运动
•有效载荷能力 **最高 300** 克
•兼容各种传感器和工具

应用与案例

•教育和研究
•工业自动化
•康复和治疗
•辅助技术
•创意艺术和娱乐

优势与益处

•价格实惠，易于获得
•易于学习和使用
•通用且可适应
•安全可靠
•用户社区

插槽的原理
The SLOTS

1. The robotic arm is more than just hardware:

Think of the robotic arm like a car. The hardware is the body, engine, and wheels, but it also needs software (the brain) and instructions (the steering wheel) to function properly. This project involves both the physical arm and the software that controls it.

2. Communication challenges:

Initially, the Therermino team tried using a standard communication method (like USB serial emulation) to connect the arm to the computer. However, this proved difficult due to the complexity of the data being exchanged and lower speed.

3. A simpler solution: slots:

Think of containers where different types of information are deposited, like letters, invoices, newspapers, advertisements, etc. The team created a similar system called "slots" for data exchange. Each slot holds specific information, like instructions or sensor readings.

4. Efficient communication:

There are 1000 "slots" for both sending and receiving data, allowing for a fast and continuous flow of information between the computer and the robotic arm.

5. Easy control:

Only two simple commands are needed to interact with the slots:

Read data: *variable = Slot (nn)* (like taking an item from a slot)

Send data: *Slot (nn) = variable* (like putting an item in a slot)

This simplified approach makes it easier to control and interact with the robotic arm.

插槽的原理
The SLOTS

1. 机器人手臂不仅仅是硬件：
想象一下机器人手臂就像一辆汽车。 硬件是车身、发动机和车轮，但它还需要软件（大脑）和指令（方向盘）才能正常工作。 该项目涉及物理手臂和控制它的软件。

2. 通信挑战：
最初，该团队尝试使用标准通信方法（如 USB）将手臂连接到计算机。 然而，由于交换数据的复杂性，这 proved 困难。

3. 更简单的解决方案：插槽：
想象一下放置不同类型信息的容器，例如信件、发票、报纸、广告等。 该团队创建了一个类似的系统，称为“插槽”，用于数据交换。 每个插槽包含特定信息，例如指令或传感器读数。

4. 高效通信：
发送和接收数据都有 1000 个“插槽”，允许在计算机和机器人手臂之间快速、连续地流动信息。

5. 轻松控制：
只需两个简单的命令即可与插槽交互：

- **读取数据：** variable = Slot (nn) (如从插槽中取出项目)
- **发送数据：** Slot (nn) = variable (如将项目放入插槽)

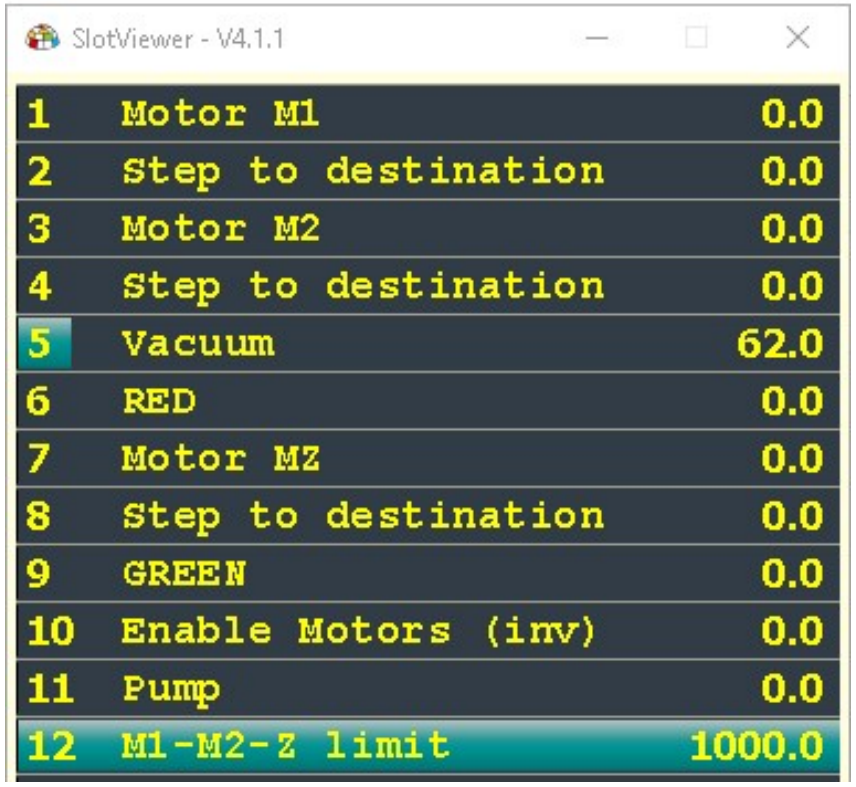
这种简化的方法使得控制和与机器人手臂交互更加容易。

软件模块:“插槽显示器”

The software modules: The “Slot Viewer”

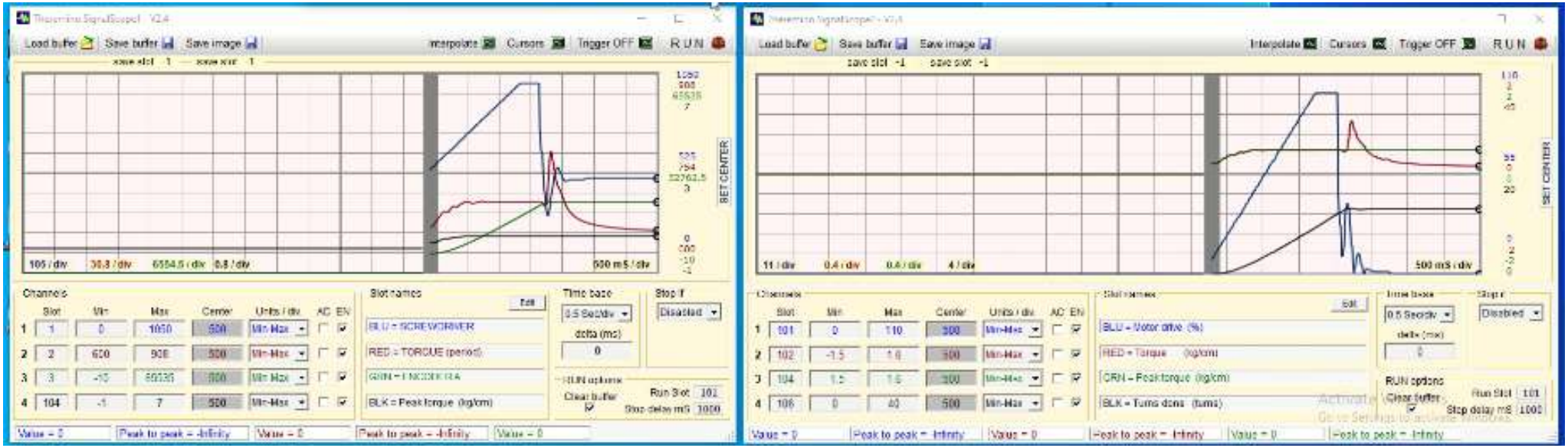
- “插槽显示器”模块可让您实时查看插槽状态。
- 插槽是 HAL 硬件抽象层模块与 Windows 环境中的应用程序之间通信原理的简化模式。
- 通过这个 SlotViewer 软件模块，可以对插槽内部的数据进行实时干预。

The "SlotViewer" module allows you to view the status of the slots in real time.
Slots are a simplified version of the communication between the HAL module and the applications in a Windows environment.
Through this module it is possible to intervene in real time on the contents of the slots.



软件模块: “信号显示器”

The software modules: The “SignalScope”



- “信号显示器”允许您以逻辑分析仪或示波器一样的形式实时查看插槽的状态。
- 插槽是 HAL 硬件抽象层模块与 Windows 环境中的应用程序之间的通信协议进行重新设计和简化的概念。该“信号显示器”模块具有存储波形及其历史的功能。

The "SignalScope" allows you to view the status of the slots in real time, like a logic analyzer or oscilloscope.

The slots are a redesigned and simplified version of the communication protocol between the HAL module and the application in a Windows environment. This module has functions for storing the waveform and history.

软件模块: “信号显示器”

The software modules: The “MOTORS”

The MOTOR program:

- Reads values from the slots.
- Converts the values into degrees of movement for each joint.
- Controls the movement of the robotic arm.

Importance:

- A key component of the control system.
- Allows precise control of the robotic arm's movement.
- Crucial for the correct execution of operations.

Notes:

- The mapping between values and degrees can vary.
- The program can be configured for different modes.

MOTOR 程序:

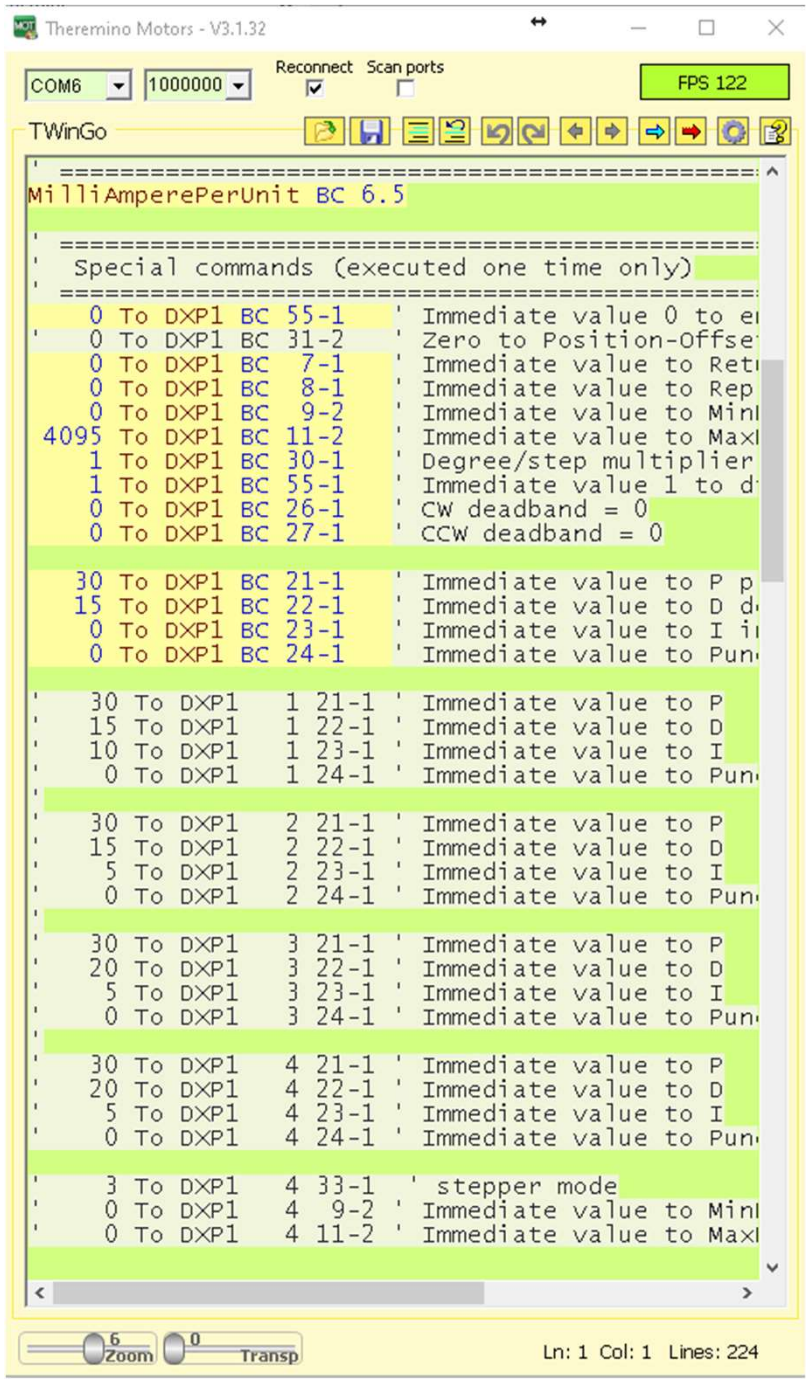
- 读取插槽中的值。
- 将值转换为每个关节的运动角度。
- 控制机械臂的运动。

重要性:

- 控制系统的关键组成部分。
- 精确控制机械臂运动。
- 正确执行操作的关键。

笔记:

- 值和角度之间的映射可能会有所不同。
- 该程序可以配置为不同的模式。



Theremino系统的其他应用

Theremino other applications

我们在官网记录了 Theremino 系统的所有应用，其中一些是完全创新的。全部严格开源。

www.theremino.com/zh/applications。

On a web page we have reported all the applications, some totally innovative.

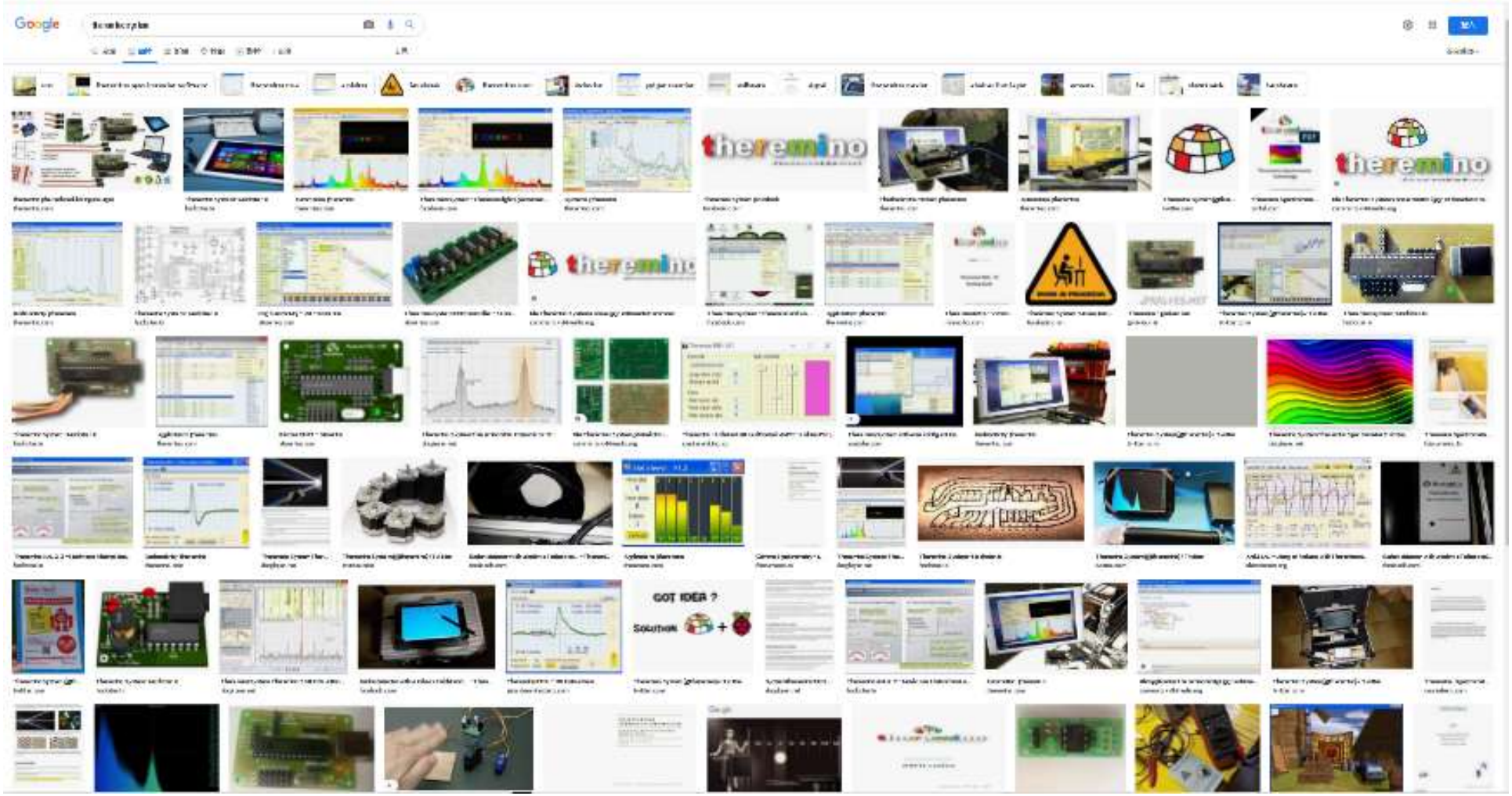
All strictly OPEN SOURCE.

www.theremino.com/en/applications

其他Theremino系统应用

… Theremino 还有许多其他应用案例

… and much more.



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“theremino”