



Incredible Machine OPEN GAME RULES



Section 0 Basic information of incredible machine

The concept of the Incredible Machine originated from a video game, where players construct a mechanism using Rube Goldberg parts to achieve remarkable tasks. This game was initially created by Kevin Ryan and published by Jeff Tunnell. In modern science education, some scholars introduce the concept of the Incredible Machine to teachers and students. Instructors have attempted to develop a control system with a simple mechanism. Each teacher will create their own control unit, and then all the teachers' works within the group will be interconnected. This results in a control system where the builder in each control unit cannot predict the final outcome of the work, making it an intriguing and unpredictable endeavor.

A single control unit comprises three essential components: input (INPUT), processing (PROCESS), and output (OUTPUT), as depicted in Figure 1. In contrast to the robot system, the input signal in the control unit varies with different types of detectors or sensors, while the processing involves a microcontroller board. The output component refers to the output devices, which may include LED displays, motors, relays, and more.

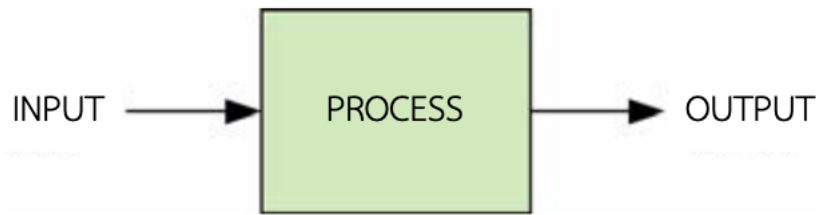


Figure 1: Components of the control unit for building an Incredible Machine.

To create an Incredible Machine, multiple control units need to be interconnected, as illustrated in Figure 2. Each unit commences its operation upon receiving the start signal. It then processes and transmits the output signal to the subsequent control unit's input, creating an uninterrupted sequence of operations until reaching the final control unit to show the performance of the whole system. It can be seen that the machine has inputs and outputs that each destination.

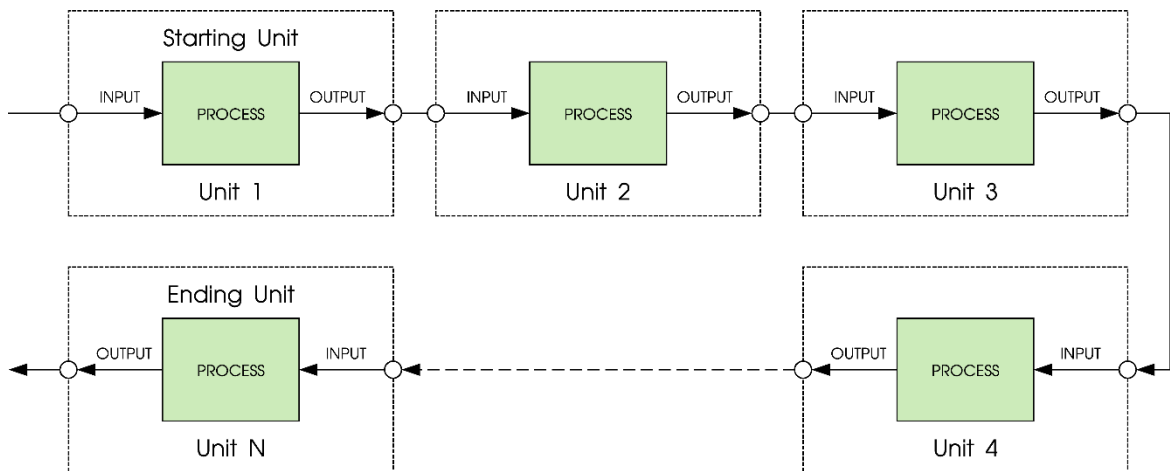


Figure 2: Basic concepts of the incredible machine.

In Figure 3, there is another incredible mechanical system that utilizes the final output of the last controller as feedback to the initial controller, leading to an astonishing machine that operates in an automatic and self-revolving manner.

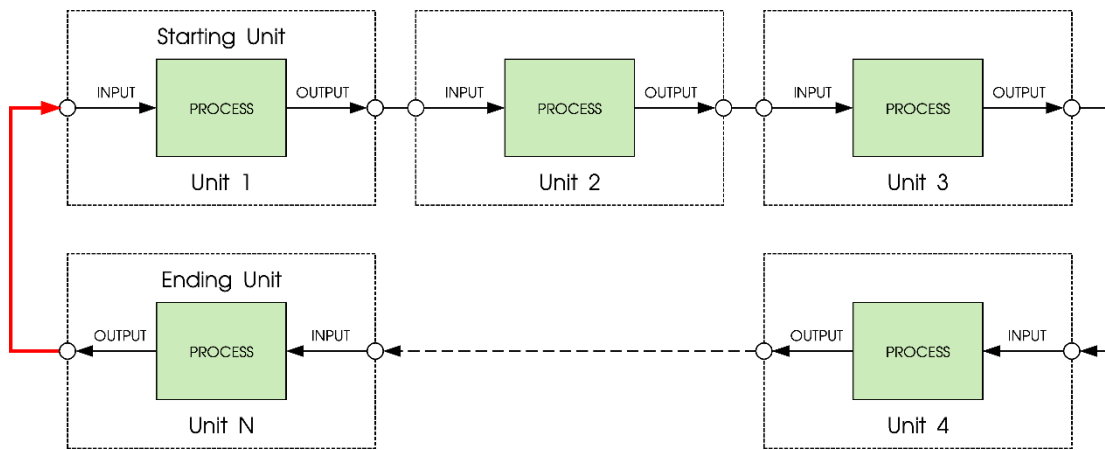


Figure 3: Fully automated loop concept of the Incredible Machine

The essence of being an incredible machine lies in its unpredictable operation before work. The machine's creation may involve using one device to perform multiple functions, and each unit's output signal transmission must be distinct. Once the system is powered on, all operations should be automated until the process is complete.

Section 1 Participants

Article 1

- 1.1 There are maximum 4 participants per team.
- 1.2 The competition has 1 age category. It is open age category
- 1.3 Every team may or may not have teacher/mentor by each team must have only 1 person (1 teacher or mentor can supervise multiple team).
- 1.4 Each participant can play only one team.
- 1.5 Each team retains the flexibility to submit an unrestricted number of robots for the contest but all of it will be count as one work.

Section 2 Robot requirements

Article 2 Size and number of the robot

- 2.1 The number of the robot is no limit. The referee will count as one project per team.
- 2.2 The robot can be any size and have to fit within the presentation area of each team. The presentation area is the flat table 110 x 60 cm.
- 2.3 The machine must have at least 4 control units.

Article 3 Equipment

- 3.1 Any type of robot is allowed. For microcontroller rules, the sole decision rests with the individual country representative or the committee in the absence of a country representative. Please contact your individual country representative/committee for more information.
- 3.2 No limit the number and type of motor.**
- 3.3 No limit the number and type of sensor type.**
- 3.4 Allows to use forceps, breadboard, general purpose printed circuit board and electrical connection materials.
- 3.4 Allows to use one or more of the controller boards to work together.
- 3.5 The number of control boards is at least 4 units.
- 3.6 The power supply is unrestricted, but the builder must be mindful of the limitations concerning the capacity of the control circuit board and the detector to endure such power.
- 3.7 Not limited to the type of peripheral equipment but must not operate as a main controller.
- 3.8 No limit of type and number of unelectric material that use for decorating the robot.
- 3.9 Competitors can use unlimited plastic model pieces or toys that do not require electricity to decorate or build the construction of the robot.
- 3.10 Participants must prepare materials, equipment, and tools to build, decorate, fix, or adapt the robot for the contest themselves. (Only lightweight tools are allowed, such as a soldering iron, pliers, screwdriver, small battery-operated hand drill, cutter, and scissors.)

Article 4 Building the robot

- 4.1 Participants can build the robots in advance.
- 4.2 The robot must operate in automatic mode only.
- 4.3 Participants are permitted to build their robots in the designated area provided by the competition management. However, it is essential to note that the available space is limited, and it will be allocated on a first-come-first-served basis. Consequently, there is no guarantee of ensuring optimal comfort during the build process.
- 4.4 Participants are permitted to display the sponsor's logo on their robots. However, it is imperative to adhere to the guidelines that prohibit the use of symbols associated with the monarchy, politics, and religion.
- 4.5 Participants are encouraged to build the robot that embodies positive creativity and imagination.

- 4.6 The robot should be designed to be compatible with installation in a presentation area measuring 110 x 60 cm, which comprises a flat floor surface.

Article 5 Basic abilities of the robot

- 5.1 The robot must demonstrate the operation to perform tasks and move continuously without any constraints on any movement method or pattern.
- 5.2 The robot should be able to operate throughout their presentation to the judges (approximately 3-5 minutes).

5.3 **The video example of Incredible Machine**

https://www.youtube.com/watch?v=r3pp1oaRT_o

<https://youtu.be/qybUFnY7Y8w>

Good example but didn't use any microcontroller (Only as guideline)

<https://youtu.be/RBOqfLVCDv8>

This example of the large project (didn't use microcontroller)

<https://youtu.be/OHwDf8njVfo>

The example of the simple system (didn't use microcontroller)

<https://tinyurl.com/WRGTH2022-IMxample01>

https://youtu.be/_v5lPvth_gE

Section 3 The competition

Article 6 Schedule

- 6.1 Participants can spend the entire day preparing, testing, and decorating your robot on the practice day.
- 6.2 Judges will observe and score any time on 2 game days.
- 6.3 Commence the presentation and demonstration to the referees, with each team allocated 3 minutes. Judges may assess teams individually or as a group.
- 6.4 The result will be announcement in the awarding ceremony.

Article 7 Theme

Theme of this WRG 2023 is **Robotics for Sustainable Development Goals**.

It is about making society better and following the United Nations' goals for a sustainable future. Participants must create and build the robotics project to support at least two of SDGs. Remember to display the SDG symbol for the chosen topic so the referees can easily recognize it.

The logo of SDGs can be download via this link:

<https://thailand.un.org/en/sdgs>

or

<https://www.un.org/sustainabledevelopment/news/communications-material/>



Article 8 Presentation format

- 8.1 The judges may inquire about the concept and creation process.
- 8.2 No need the presentation document and any poster or chart. Judges would be seen and focus the robot operation only.

Article 9 Judgement

- 9.1 The judges will evaluate the performance, creativity, and alignment with the contest theme, irrespective of the type, brand, or price of materials, equipment, and tools used in creating the robots.
- 9.2 Efficient and continuous operation during the presentation period will impact the judge's decision.
- 9.3 The decision will be divided into two main parts:
 - 9.3.1 Score based on the performance of the robot.
 - 9.3.1.1 Fully automated operation of the entire system will earn a perfect score of 100 points.
 - 9.3.1.2 If each control unit functions correctly, but the results cannot be passed on automatically, a deduction of 10 points per unit will occur. This deduction implies that the robot cannot transfer the result from one control unit to the next autonomously. While participants are allowed to assist and encourage the

process to continue, 10 points will be deducted for each such instance.

9.3.2 Judges will consider elements of efficiency, creativity, and a positive attitude as important factors.

9.4 The size and number of robots will be taken into consideration, and if they are deemed unreasonable and excessive, it may affect the evaluation.

9.5 The order of presentations has no effect on consideration.

9.6 During the competition, the judges' decision is final.

