

Toy Design Competition 2022

Automata Category: Urban F1 Car Racing

1. Introduction

This competition is an exciting activity that provides a platform for students to challenge their creativity and skills in designing fascinating animated mechanical toy sculptures called Automata.

Automata are originated from the Cabaret Mechanical Theatre (CMT), a highly acclaimed travelling exhibition originated from the UK that combines the work of Arts, Science and Technology. Nearly all of the work in the CMT collection is humorous. These mechanical toy sculptures showcase the fine art of engineering and are valued highly in the collectors' circle. They can be brought to life by cranking a handle to move a shaft mounted with a series of machine parts such as cams, gears, linkages, belts and pulleys, ratchets, etc. which are in turn connected to the various parts of the sculptures to produce the desired movement.

This year the theme is "Urban F1 Car Racing". Singapore had the honour of hosting the first night-time race in 2008, since then it has been a place to go to for F1 enthusiasts. In this competition, we want students to re-imagine what it would like to have F1 car racing through not only the designated tracks but also various places in Singapore or explore different types of racing that redefines urban racing.



This Toy Design Competition 2022 is organised by the Singapore Polytechnic's School of Mechanical and Aeronautical Engineering.

2. Competition Rules

- 2.1 The theme of this year's Automata Design Category is "**Urban F1 Car Racing**".
- 2.2 Participants are required to create Automata that showed events where F1 car racing would be possible, new ways of racing or racing through different sceneries in Singapore.



- 2.3 Participants shall use the appropriate mechanisms, such as gears, cams and linkages, etc. to drive their automata in order to deliver their respective interesting and memorable stories.
 - 2.4 The competition is open to all Secondary School students in Singapore.
 - 2.5 The number of students in each team should not be more than **five***
 - 2.6 Each individual or team shall submit only one entry.
 - 2.7 The size of each Automaton should not exceed **45 cm (Length) x 35 cm (Width) x 40 cm (Height)**.
 - 2.8 Participants may design and draw their Automata assemblies and parts manually or using any CAD software. However, the use of CAD software will help them to design, size, dimension and animate their automata movements more effectively before they start to fabricate it.
 - 2.9 A Special Award will be presented to the team that can use any CAD Software to design and generate their Automaton with best virtual animation effect.
 - 2.10 To further increase the challenge, teams that can replace the hand cranks using battery-powered motors with gearing or belt drives will be awarded with 5 extra bonus points (see 5. Judging Criteria). This is optional.
 - 2.11 Batteries that are acceptable in this challenge are: dry-cell alkaline batteries and Alkaline batteries, where each individual battery is not to exceed 9v. The batteries need to be easily replaceable. (see Annex).
 - 2.12 Batteries that are not acceptable are: Li-ion, Li-Po, powerbank, Lead-acid or any form of rechargeable batteries.
 - 2.13 Motors to be used: Not to exceed operating voltage of 12V DC. (see Annex).
 - 2.14 The circuitry for the battery-powered motor needs to have an off/on switch. (see Annex).
 - 2.15 Any exposed gearing or belt drive needs an encasement for safety reasons.
- 3. Design Guidelines**
- 3.1 Participants should first visit various Automata websites, such as the <http://www.cabaret.co.uk/>, <http://automata.co.uk/> and <http://www.flying-pig.co.uk/> websites before embarking on their own design. They should also visit various Design and Technology websites, such as the <http://www.technologystudent.com/> (click “MECHANISMS” and “GEARS AND PULLEYS”) to learn how Automata parts can be animated by gears, timing



belt and pulley drives, cams, linkage mechanisms, ratchet mechanisms, crank and crank shafts, etc.

- 3.2 Participants are required to build their Automata using materials such as plywood, chipboard, softwood (balsa), wood, ball/ cube/dowel, basswood sheet/strip, ice cream stick, plastic, high density foam, kapaline board, etc. They can also use 3D Printer and 2D Laser Cutting Machine to create their Automata parts.
- 3.3 Participants should use a $\varnothing 10$ mm steel rod or $\varnothing 12$ mm wooden rod as the main cranking shaft and driving shaft(s) of other critical Automata parts so as to minimize shaft deflection and power transmission losses which will result in malfunctions of moving parts.
- 3.4 The Automaton crank should be installed on the right-hand side and the direction of cranking should be indicated on the same side. Clockwise direction of cranking is preferred.
- 3.5 Parts may be joined together by adhesive (glue), nails, self-tapping screws or dowels. Pins may be used to create joints. Strings, wires, standard gears, belts and pulleys, etc., can be used to create the movements of the Automata.
- 3.6 Compression, extension and torsion springs of appropriate size and stiffness (about $\varnothing 0.5$ mm wire diameter) should be connected to cam followers, cranks and linkages, etc. to create the return or oscillating movements of moving Automata parts.
- 3.7 Participants should source for the above mentioned materials and standard parts before sizing their Automata. These materials and standard parts can be purchased from shops, such as Art Friends, Daiso and hobby shops.

4. Competition Details & Prizes

- 4.1 The submitted entries will be judged and ranked by a panel of judges formed by the organising committee.
- 4.2 The prizes are:

1 st Prize	\$500 Cash Voucher + Trophy for School
2 nd Prize	\$350 Cash Voucher + Trophy for School
3 rd Prize	\$200 Cash Voucher + Trophy for School
5 Merit Prizes	\$100 Cash Voucher each

Special Design Award for team with best virtual animation effect using any CAD software (\$100 Cash Voucher). Animation file must be in mp4 or avi format.

Commendation Awards for all deserving entries (\$50 Cash Voucher).

4.3 Special prize – a prize will be given to 1 lucky person who has voted correctly for the most popular automata. Details on the voting will be announced at a later date.

4.4 All winning students will be presented with certificates.

5. Judging Criteria

Design Description	10%
Poster Design (A2 size .ppt template)	10%
Functionality	20%
Model Quality	20%
Originality and Creativity	40%
Bonus score (replace hand crank with motor)	5%

6. Registration & Final Submission

6.1 Participants are to register their interest to their teacher I/C. The teacher I/C shall collate and submit to the Organising Committee using the registration form available at <https://www.sp.edu.sg/engineering-cluster/mae/life-@mae/toy-design-competition/2022>.

6.2 Closing date for competition registration is **29th April 2022**.

6.3 Participants should submit their entries through their teacher I/C to the Organising Committee by **19th August 2022*** for judging.

6.4 Each team's submitted entry must include:

- The physical model of the Automaton (may be required for proof)
- a learning journey portfolio for the automaton.
- the portfolio shall be in electronic format, which shall include description, story behind the automaton and the engineering components that are going to make the automation work. You may include pictures of sketches, prototypes (if any), video of the automaton in action (if any) and/or software animation (if any).
- the portfolio's electronic format, shall be in PowerPoint (pptx, ppt, ppsx) or Google slides. All items are to be embedded (especially videos) into the powerpoint/Google slides (poster to be excluded). Please include team name, school and team members in the first slide of the powerpoint.
- The softcopy of the following through download link (eg. Google drive, dropbox, wetransfer, Google drive etc.):
 - Portfolio
 - One A2-size poster based on the template which is downloadable from the website. The poster shall include:
 - The name of the Automaton.



- A group photo of the participating team with students' full names (from left to right) and the name of the teacher and school below it.
 - A short write-up of the Automaton with not more than 100 words. The write-up shall include its storyline, how each of the movements is being actuated by the various mechanisms.
 - Either a scanned image of the manually drawn pictorial sketches or 3D rendered or shaded image of the design (if CAD software is used).
- Teachers are to collate the link and submit the details in 1 excel file. Please ensure that the links are accessible. Videos are to be uploaded together or upload to video sharing platform such as Youtube or Vimeo. Ensure that videos are set to either public or unlisted.
- 6.5 Teachers can store and submit all their students' entries through a download link if there are many entries to be submitted. Submission entries must have the Automaton Title and Name of School clearly labelled.
- 6.6 All works submitted should be original and should not have been awarded by the organiser of another similar competition before.
- 6.7 All participants are responsible in ensuring their submission will not infringe existing copyright/patent law.
- 6.8 The Organising Committee or sponsor is not liable for infringement or abuse of any design as a result of entry in this competition or as a result of subsequent publicity.
- 6.9 Entries that do not meet the competition rules will be disqualified.
- 7. Pandemic Measures (COVID-19)**
- 7.1 In the event that the pandemic situation worsens, the committee reserves the rights to make changes to the rules and regulations of the competition.
- 7.2 Depending on MOE advisory, the committee will announce the changes to all participants through email and TDC.22 website. The changes may include and not limited to:
- Judging criteria of entries
 - Submission format of artefact - If submission of physical artefact is not possible, video submission of the artefact in action may be required. By default, there will be no physical submission except for the top few entries (teachers will be notified).

8. Announcement of Results

- 8.1 Owing to uncertainties in the current COVID-19 situation, the winners and their ranking will be announced via online platform e.g. zoom or team meeting by mid-Sept 2022. Participants and teachers will be informed on the exact date through email.
- 8.2 In the event of a tie, the organising committee reserves the right to redistribute the prizes.
- 8.3 All decisions made by the judging panel are final.

For more information and registration, please contact:

Toy Design Category (Automata) Leader:

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Annex:
Pictures of acceptable batteries



Typical 12V DC motor



Typical On/off Switch

