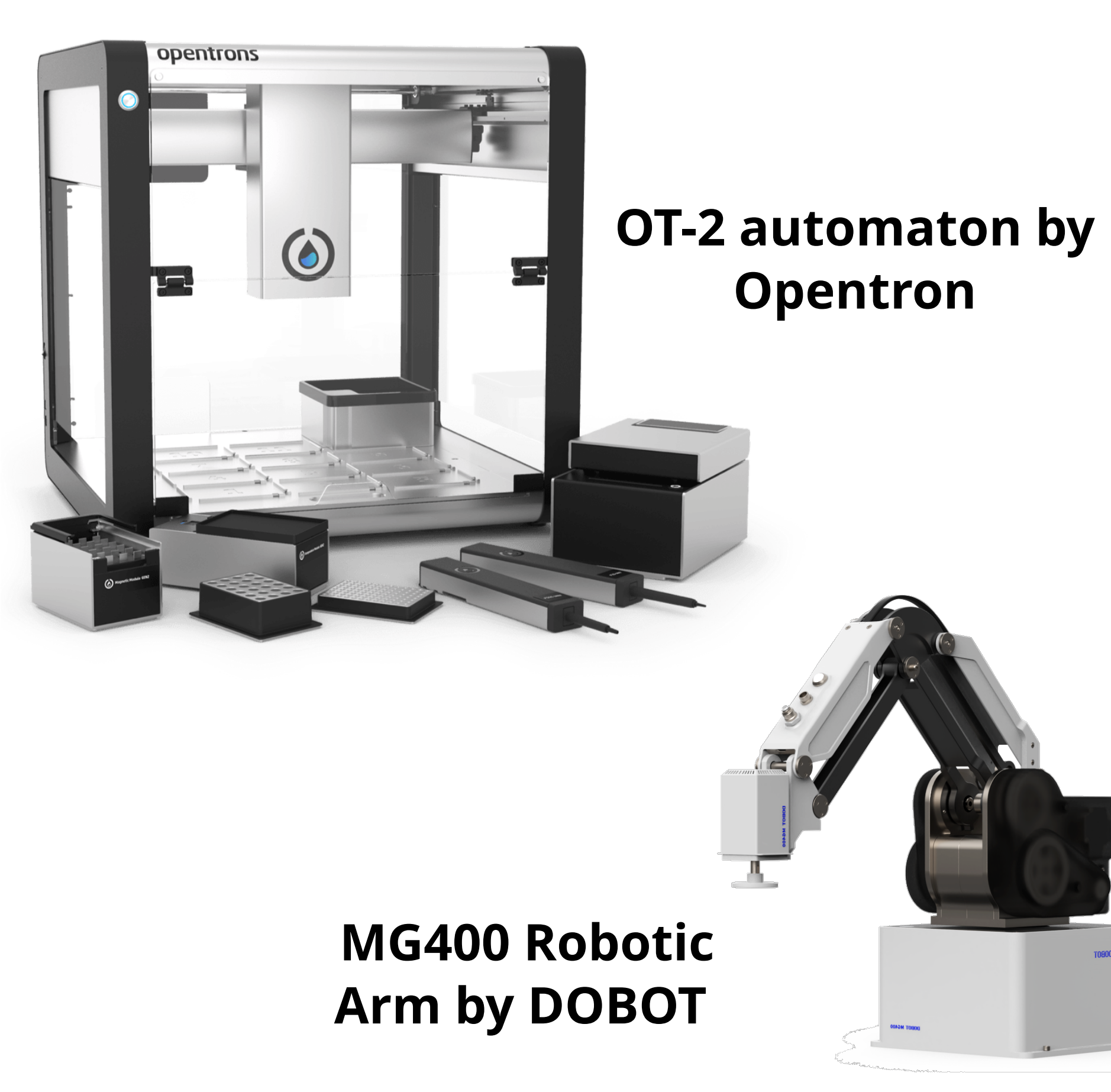


## ABSTRACT

Today, the **community consensus** to store digital information on DNA is to use **short-single strand DNA (ssDNA) molecules**. This approach has some limitations: encoding constraints, DNA stability, recovering DNA, sequencing technology, etc. To overcome them, we chose to store information on **long double-strand DNA (dsDNA) molecules**. It was the **dnarXiv project**. As a **proof of concept** of this design methodology, we encoded the first articles of the **Universal Declaration of Human Rights** (4.2 ko text document) on a **single 24 Kbp DNA molecule**. We sequenced this molecule using Nanopore technology and were able to retrieve the original text.

Currently, the **construction** of long dsDNA molecule is done by **"hand"**. It's time-consuming, not parallelizable and tedious: **4 days to build 1 long DNA molecule**. To be convincing, **our DNA information storage solution must provide a experimental DNA storage platform with scale-up capacity**. In this end, **DNAmaker project aim to fully automated the DNA construction part of the dnarXiv pipeline with high flexibility in protocols**.

## DNAmaker AIM AND EXPERIMENT



**Aim: automated the building of long dsDNA molecule**

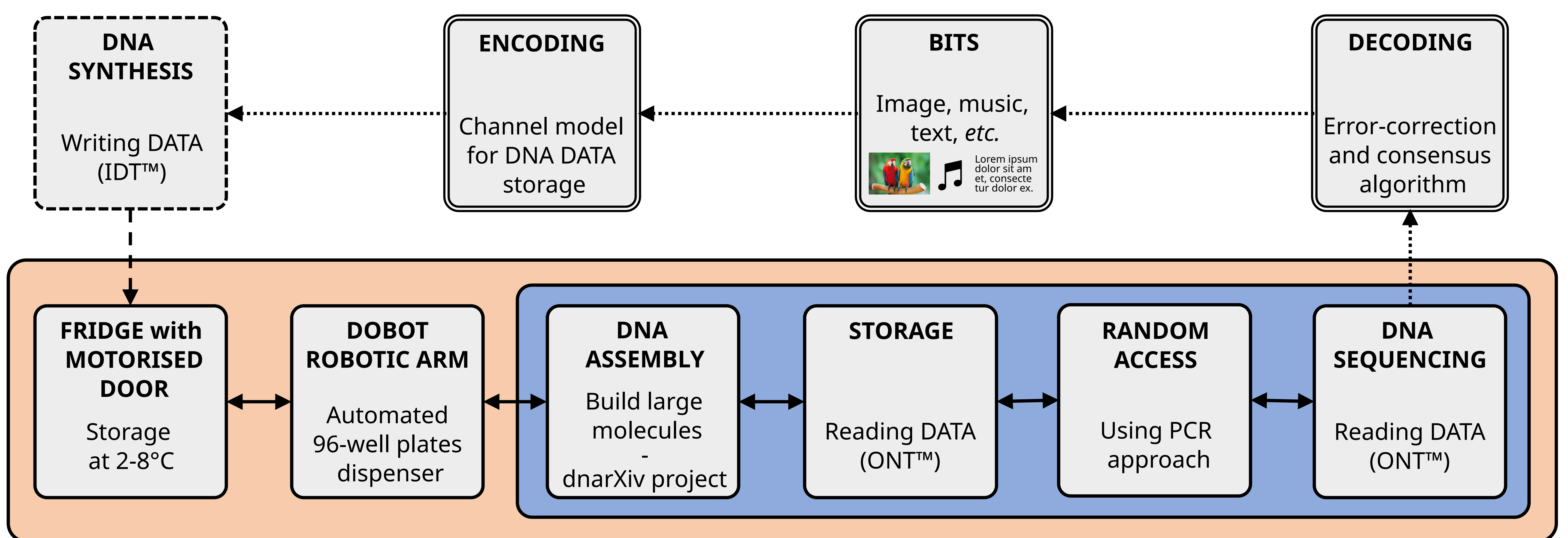
**Biological operations:** restriction endonuclease, DNA ligase and DNA polymerase  
 --> On OT-2 which has different modules to perform multiple enzymatic operations.  
 --> Assembly method was published on Biotechniques:  
 Fully in vitro iterative construction of a 24 kb-long artificial DNA sequence to store digital information - J. Leblanc, O. Boule, E. Roux, J. Nicolas, D. Lavenier, Y. Audic

**Handling operations:** move 96-well plates between the storage platform (fridge) and the OT-2 automaton with the DOBOT arm.

**Experiment: automated build, store and read dsDNA molecules coding for the 30 articles of the Universal Declaration of Human Rights (8.7 ko text document)**

--> Development: communication and coordination between OT-2 automaton, DOBOT robot arm and the motorized door refrigerator.  
 --> Programming: in Python language. Run on local server with Jupiter Notebook.  
 --> Protocol optimizing and validation by proof in real conditions.

## DNAmaker WORKFLOW OVERVIEW



- Externalised
- On DNAmaker platform
- On computer
- Workflow module
- DNAmaker platform
- OT-2 automaton
- Computer operation
- Automatic operation
- Manual operation

Watch it on YouTube!

