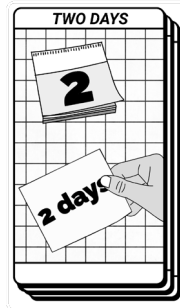


# SCRIPT 9

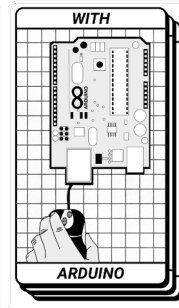
Constraints:



Spies

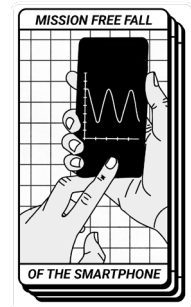
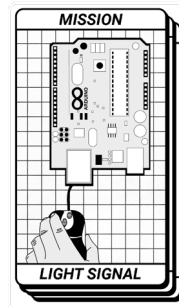
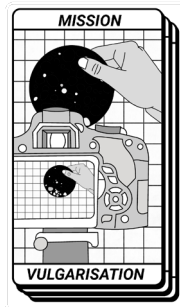
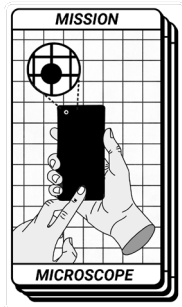


2 days



with Arduino

Tasks:



## 1 The story in two words

The students embody a group of engineers in support of operations carried out in the field. They discover that they must assist a secret agent who has recovered North Korean leader Kim Jong Un's smartphone.

## 2 Preparations

You need a place where students can work in groups, and craft together. Ideally, a place that is unknown to them, so as to get them out of their habits. A TD room may be suitable, if it is not too full of tables (and if the tables are installed in an island). You also need a place for the ultimate test, with a height difference of about 5m: window, footbridge. Obvious safety conditions must be taken when throwing objects out the window. For hardware, see below.

### 3 INTRODUCTION

Show students the video "KJU I8": an Agent in South Korea indicates that he is assisting a spy in North Korea who recovered a micro sample from Kim Jong Un where he was invited, this seems to indicate a code but he can't decipher it. He is there. You have to send him a way to make a microscope with the tools on board, he suggests that they follow the MM27 protocol.



**optional:** The supervisor gives them a way to communicate with the spy (ex: via minnit.chat or a whatsapp channel or a discord that the supervisor will use in secret to play the spy). Then let the participants possibly ask questions to clarify the mission.

You need a place where students can work in groups, and craft together. Ideally, a place that is unknown to them, so as to get them out of their habits. A TD room may be suitable, if it is not too full of tables (and if the tables are installed in an island). You also need a place for the ultimate test, with a height difference of about 5m: window, footbridge. Obvious safety conditions must be taken when throwing objects out the window. For hardware, see below.

### 4 TASK : SMARTPHONE AS A MICROSCOPE

DAY 1 / morning

*Students must design and characterize a microscope with a drop of water on their smartphone. They follow the MM27 protocol.*

MM27 protocol (pptx)

MM27 protocol (pdf)

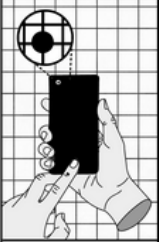
The protocol requires several actions, which can be more or less advanced depending on the objectives of the session and the level of the students:

- measure the magnification due to the drop (by finding the same way to measure it on the different smartphones, for example by magnifying a calibrated object like a ruler)
- measure the effect of the size of the drop of water calibrated as precisely as possible: we will see that the magnification varies inversely to the size.
- develop the most efficient sample holder possible with frugal means
- make an illustrated manual

For the final test, you have to choose an object to photograph. Banknotes are good objects, there are many small details hidden in them (especially in the arches of the bridges, we find the word EURO in the different alphabets of the EU).

**Alternative:** each team photographs a mystery object and the other teams have to guess which object it is.

MISSION



MICROSCOPE

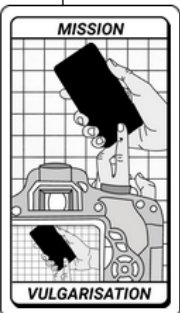
After the final tests, the team must agree together (or on quantitative criteria) which is the best prototype and the supervisor announces that he will send the plan and photos to the spy immediately.



## 5 | TRANSITION

show video "KJU T9A": the agent in South Korea indicates that the user manual must now be transmitted to the agent in North Korea but without being detected! Idea: use YouTube accessible in North Korea by creating a tutorial-style video that explains the principle of the microscope, the physics, how to manufacture it and characterize it by slipping into an existing channel. So make a youtube or tiktok video like a famous youtubeur or tiktoker who does all that. And they'll put it online and the agent can watch it. Protocol to follow: YT98





## 6 TASK : VIDEO OUTREACH

**DAY1 / afternoon**

Students must design Youtube-style videos in small groups that explain the principle of the microscope, how to make it, etc.  
First encourage them to identify a youtube channel or type of format they will emulate (Bill Nye, famous youtubers, documentary, tiktok, etc). Check that they are not all the same.  
At the end of the event: collective screening of all the videos. They are informed that in parallel these videos are sent to the North Korean Youtube which allows all scientific videos to pass.

**On the practical side:** warn them that editing takes a long time to do, and encourage them to do it live on their smartphone. Force them to do a little retroplanning that anticipates the time of editing and exporting the video.  
**Useful links:** editing on Android smartphone with Youcut or on iOs with iMovie or KLinemaster / on PC or Mac with VSDC <http://www.videosoftdev.com/fr> or iMovie or MovieMaker / stop motion on smartphone: stop motion studio

YT98 protocol (pptx)

YT98 protocol (pdf)

At the end of the event: collective screening of all the videos. They are informed that in parallel these videos are sent to the North Korean Youtube which allows all scientific videos to pass. We then wait for the agent's return to South Korea (for the next morning).

## 7 TRANSITION

**DAY 2 / morning**

show the video "KJU T9B": the agent in South Korea indicates: the spy discovered a pin code via the microscope, he wants to transmit it via a tangible light channel thanks to the Arduino and AR22 protocol.





## 8 TASK : ARDUINO AND LIGHT CODES

In this test, students must first design an LED system that emits any succession of ON and OFF and if possible another system that detects it.

Then they have to test that they are able, between them, to transmit and decode a 4-digit secret code with the encryption system they want.

Optional: we choose the prototype that works best and we wire it with a longer cable distance (5 meters) and we separate the students (two different rooms, or at the top and bottom of a window) and we give a code to one of the groups, the other to decode it.

Give participants the link to the AR22 protocol.

AR22 protocol (pptx)

AR22 protocol (pdf)

labels (pptx)

labels (pdf)

**Practical course of the test:**

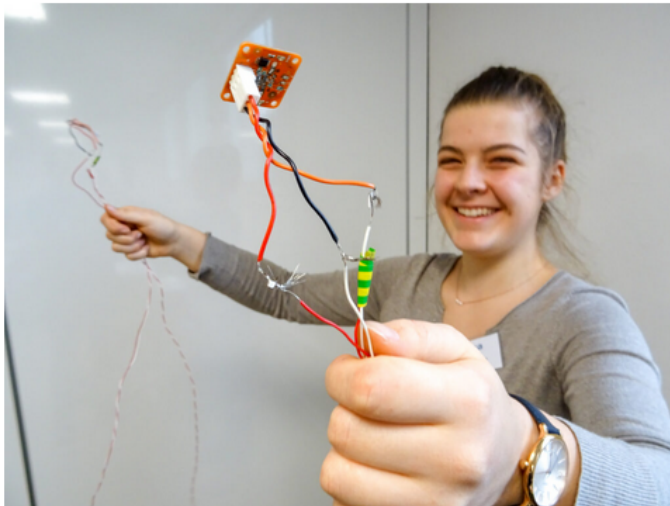
A sufficient number of Arduino kits must be provided: Arduino card (Uno for example), LED, resistor, light sensor (preferably analog, it's simpler). Also provide a reel of wire (prefer cables with several wires, to facilitate handling of long lengths), and welding equipment and cutting pliers.

If the students have never used microcontroller boards, they should be given an introductory lesson. A teacher plays the role of "Arduino specialist" and comes to train the team at the bare minimum: he quickly explains the principle of a microcontroller board, and gives the boards the task of "testing your board", "turning on a led" and "measure voltage" from the opentp.fr website (<http://opentp.fr/card/>). For students who have knowledge of programming and have done some electricity, 30 minutes is enough.

Depending on the students and the objectives, additional constraints can be added ("additional constraints issued by the operational team")

- change cable length
- impose a fast flow in transmission and reception of light signals
- impose a morse encoding/decoding by the microcontroller

The event ends with a collective session of tests and demonstrations. The students must then agree together which is the best prototype and the supervisor announces that he will send the plan and photos to the spy immediately.



## 9 TRANSITION

show video "KJU T9C" video transition 9 C: the agent indicates that they have recovered the light code → 4 digits and a smartphone. The spy had to retrieve a smartphone. He'll send them from a wall in the DMZ. There is a security camera. The GH12 protocol must be followed.



## 10 TASK : SMARTPHONE FALL

DAY 2 / afternoon

*The test consists of making a protection to be able to drop a fragile object from above by following the GH12 protocol. Frugal materials are provided, and students work in groups.*

Choose from 2 versions of the GH12 protocol to give to students:

- a simple version, the only instruction is that the egg resists the fall.
- a more advanced version, which requires students to do a video analysis of the fall to assess the frictional forces of the air.

GH12 protocol (pptx)

GH12 protocol (pdf)

advanced GH12 protocol (pptx)

advanced GH12 protocol (pdf)

Do not hesitate to adjust the constraints according to your students and your objectives, for example:

- the camera must be able to film the fall, which forces the students to slow down the fall (set a minimum duration)
- once the device is on the ground, you have to be sure that the camera has a precise orientation (to film in the right direction).

This activity can be more or less advanced depending on the constraints you impose:

- tracking of the fall by video analysis (use the Fizziq application for example)
- impose a minimum time and orientation constraint during the fall in order to film it.

**Typical process :**

**Device manufacturing time: 1h30** - The students design a device in groups, test it, improve it.

**Final test: 20 to 30 mn** : all the groups, one after the other (or all at the same time if time is short), test their device in real size (drop it from a height of about 5 m) and check whether the conditions emitted by the protocol are verified. For this test, the smartphone is replaced by an egg: the egg must be intact at the end of the fall. All the students must then agree on the device to be sent to the astronauts (take a photo of the plan and the device that is sent to the spacecraft).