The first 3D clock mobile application

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Based on a 2016 technical survey of the former clock of the Notre-Dame cathedral in Paris[1] I made as an independent researcher, I have created a 3D model of that clock in 2020, as well as a mobile application in 2021. This application is currently only available for Android platforms, but might be made available for iOS in the future.[2]

As far as I know, this is the first application of its kind, namely a mobile application making it possible to visualize and explore an entire 3D model of an actual tower clock. It is probably also the first time the kind of remontoire used in this clock is accurately rendered and animated in 3D.

The application can be obtained from:

`https://play.google.com/store/apps/details?id=com.RoegelSoftware.NDPClock`

and the 3D model (as files in STEP, OBJ and STL formats) is available at:

`https://github.com/roegeld/notredame`

How was this application made? I have used the Unity game engine[3] and loaded the various OBJ files of the model. The parts corresponding to these files were translated to their actual locations, using a list of positions that I had made available with the model. Afterwards, I merely had to animate some parts by rotating them appropriately as functions of time. In addition, there is some code for moving the observer, depending on

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[1] The cathedral's roof and spire burnt on April 15, 2019, and the clock was also destroyed. As far as I know, my technical survey is the only one ever made before the destruction.

[2] The main reason for not making an iOS version is that I do not have access to an iOS device.

[3] https://unity.com

his/her actions. A simple interface was provided for moving the user left, right, up or down, backwards or forwards, for tilting the view clockwise or anticlockwise, for changing the point of view to some predefined positions, for the display of an information box and for triggering or stopping the animation. Moreover, the point of view can be changed by touching the screen and pinching can be used for zooming. Only the going work is animated. It can actually be run at three different speeds. The striking works have not been animated, but might be animated in the future.[4] One should also note that flexible parts have not been modelled as flexible objects, and consequently some parts such as the suspension spring are actually rigid. This might also be improved in the future.

The "information box" shows the name of a part when it is selected (in which case its color changes temporarily to some random colour), according to the nomenclature defined in the *github* archive given above.

Admittedly, some interactions could be improved. Moving around the clock is not that natural, as one has to perform a sequence of translations and rotations around the viewer, but it works reasonably well. A future version might allow for a rotation around a specific part in the model.

There are also restrictions in the motion of the user, so that he/she does not collide with the clock.

In any case, this application shows how a complex assembly, not necessarily a clock, can easily be integrated in a mobile application. All that is needed is to have all parts of the assembly as separate OBJ files, with wheels and levers centered on their axis, and a list of actual positions. In my case, there were only translations, but in other cases there might also be rotations. The animation of the assembly will depend on the assembly itself, but it should not be more difficult than in the case of the Notre Dame clock.

The following screenshots illustrate some of the features of this application.

[4] If that happens, I will add the currently (intentionally) missing detent (which is part of the 3D model). I have in fact only animated the part of the clock which was working when I saw it. The striking works were no longer in function in 2016.

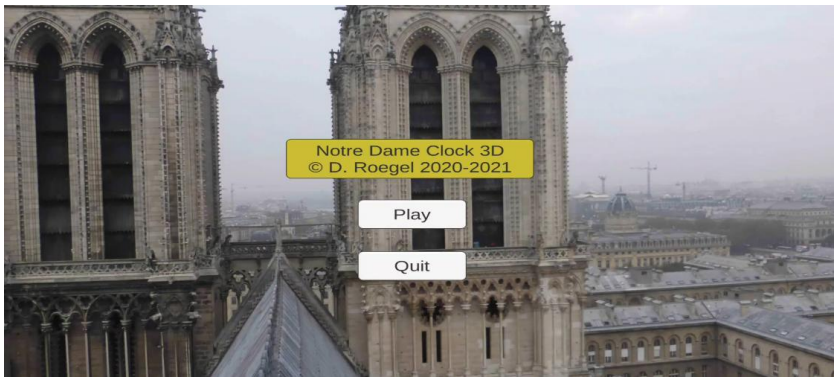

Figure 1: The initial screen, with the two towers of Notre Dame. This is a picture I took when I climbed on the spire in 2016.

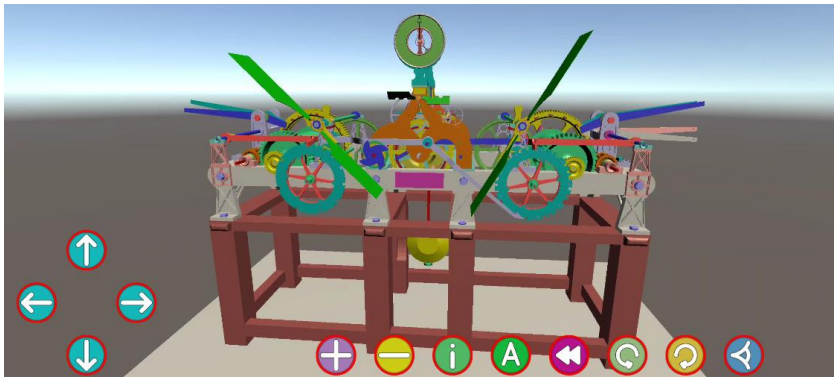

Figure 2: Once "Play" has been clicked, this is the screen seen by the user. He/she is facing the clock, and there are various buttons. These buttons were all custom made.

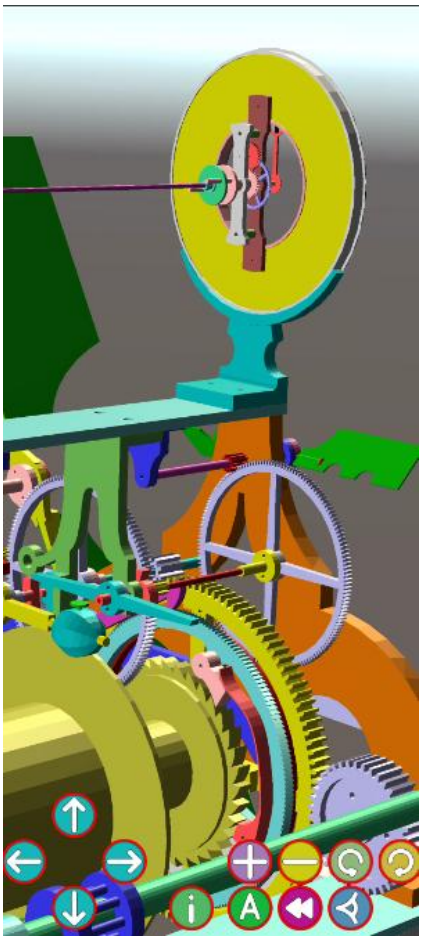

Figure 3: A portrait view, showing the slightly different layout of the buttons.

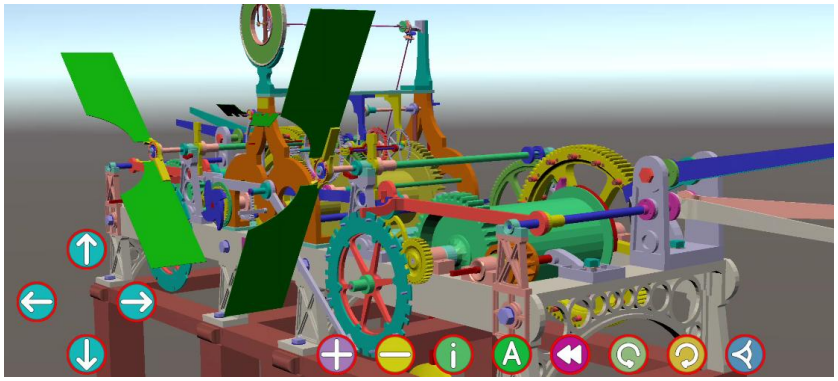

Figure 4: The clock seen from a different position.

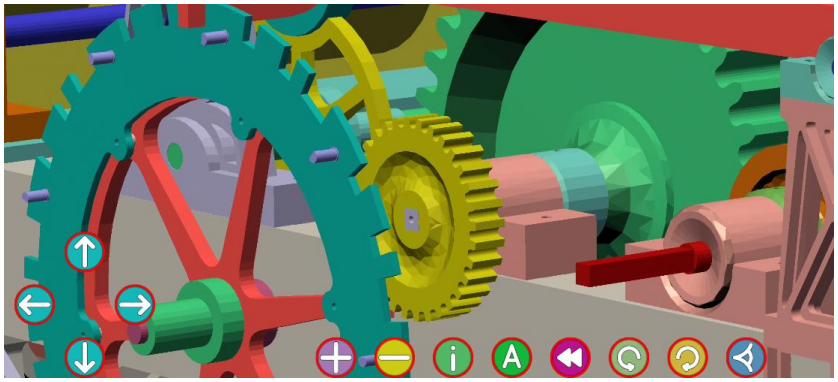

Figure 5: A close up of the clock. "+" and "−" move the actual position of the user (player), whereas pinching the screen zooms in and out. Rotations using two fingers have not been implemented, but the viewing direction can be changed with one finger.

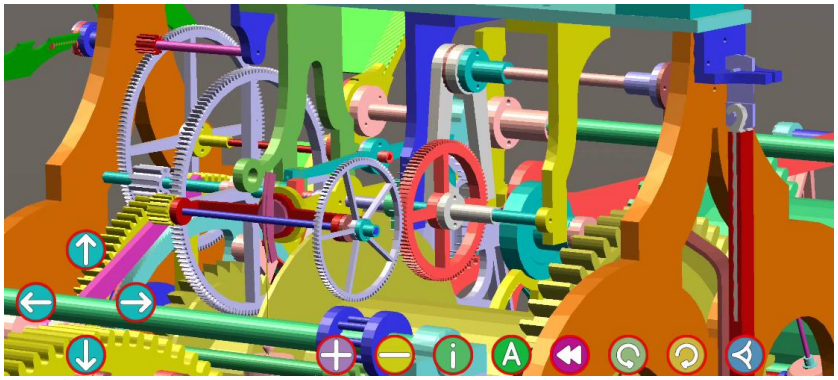

Figure 6: Another view.

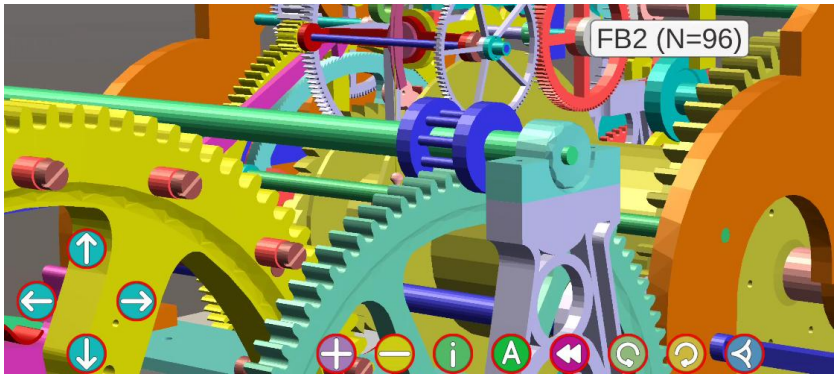

Figure 7: In this view, "i" has been activated, that is the "information box." Now, when clicking on a component, its name (given in the original model) is shown, here FB2. If it is a wheel with teeth, the number of teeth is shown (here 96). When clicking again on "i," the "information box" is unactivated.

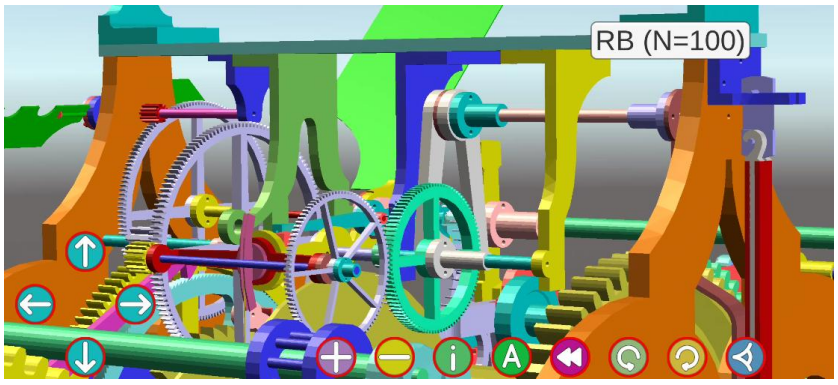

Figure 8: When a wheel is selected, its color changes. Here the escape wheel RB, which is normally red, is shown in green.

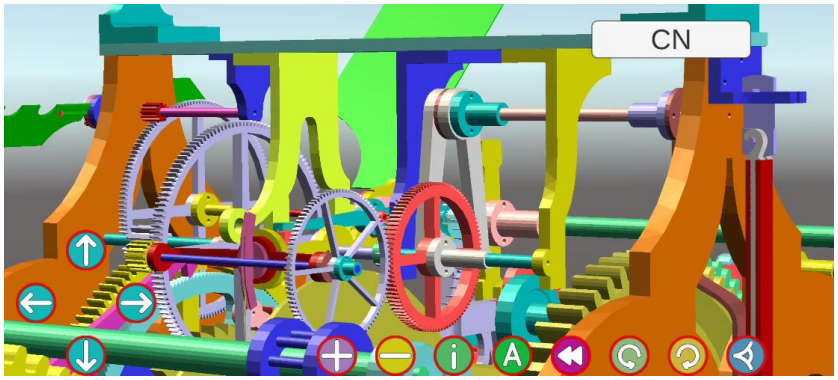

Figure 9: Here a structural support (CN) has been selected, but there are no teeth numbers.

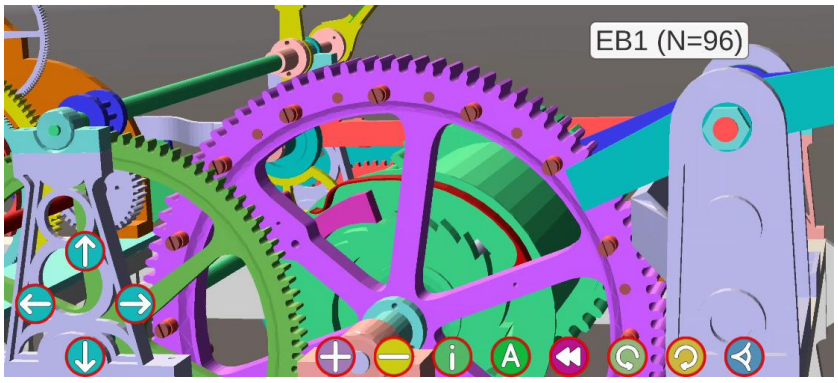

Figure 10: The first wheel EB1 of the hour striking work has been selected and appears in purple.

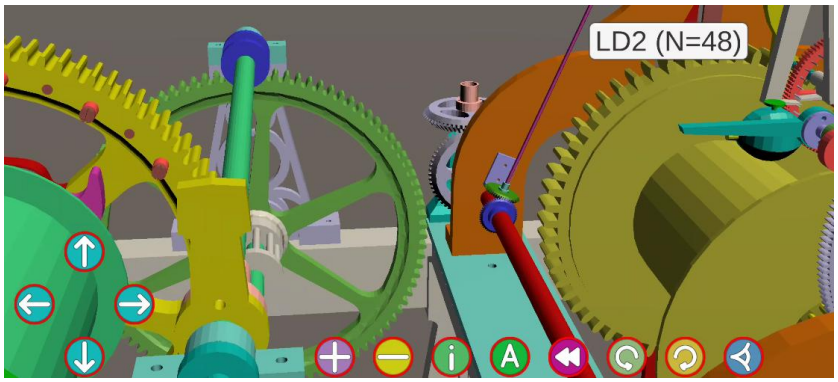

Figure 11: The small bevel gear LD2 has been selected (in green in the back and above the button "A").

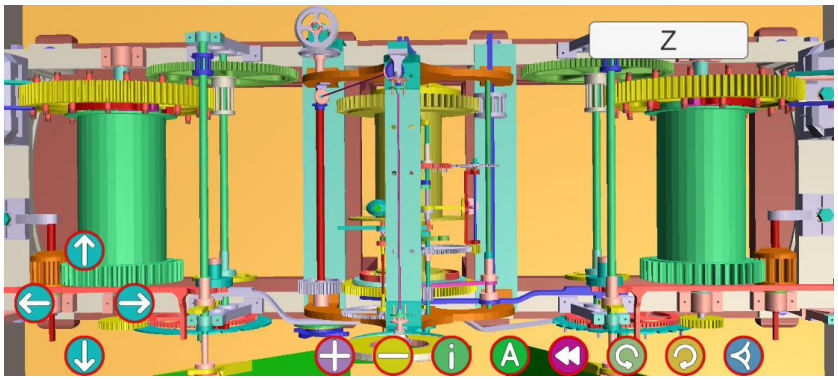

Figure 12: A view from above the clock (with the floor Z selected).

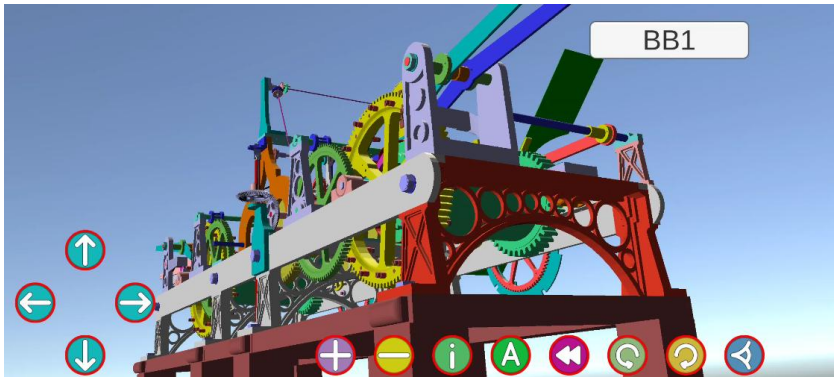

Figure 13: Another view with the end support BB1 selected.