Product Requirement Document

Software title:

Practical tools for Engineering

Background:

This software contains two functional modules, which are a simple U-value calculator and a unit converter.

The U-value calculator supports users to calculate the U-value of architectural structures, such as walls, windows, doors, etc. It should be note that this is a very simple calculator and it can only calculate the U-values of structures which have a maximum number of plies of 5. In this module, we have already provided some common materials and the λ value of them. However, this is not very detailed.

The unit converter is always used to switch the unit of data. It contains different kinds of unit class, including volume, length, area, temperature, pressure, energy, power, force, velocity, density, mass concentration, molarity, surface tension and viscosity. This module supports users to convert common units of data.

Motivation:

Both of the two functions of this software are very useful in AEE field. As an architectural engineer, our work is also highly related to calculate. We are usually required to analysis the properties of architectural structures and the materials of them. During this process, calculating is necessary. However, in some situations, the

units of the given data may be not an international standard one, then a tool that used to switch the units will be highly required. Thus, we have made this Practical tools of Engineering.

Key functions:

We have written three main python files to complete this software. For the U-value module, the key function is called “u_value_calculator.py”. For the unit converter module, the key function is called “unit_converter.py”. Then, in order to successfully run the combined software, we need a final file, and it is called “cw_part4.py”. Additionally, there is also an important helper function called “graphics_helper.py” using in this software.

Algorithm/Scientific Methods:

For the U-value calculator module, the algorithm method is as shown:

$$U = \frac{1}{R_t} \qquad \textit{Equ.1}$$

$$R_t = R_1 + R_2 + R_3 + R_4 + \cdots + R_n \qquad \textit{Equ.2}$$

$$R = \frac{Thickness(m)}{\lambda(W/K \cdot m)} \qquad \textit{Equ.3}$$

For the unit converter module, we have collected some basic and common international units and summarized the conversion relationship between them. It is as shown in the documents between the following link:

https://nottinghamedu1-my.sharepoint.com/:w:/r/personal/ssyzg2_nottingham_edu_cn/_layouts/15/Doc.aspx?sourcedoc=%7BE9F4D3D6-238F-482F-9E2A-26EFD5FC6627%7D&file=Unit_converter.docx&action=default&mobileredirect=true

Similar products:

There are also many other similar software in the market. One of the U-value calculators is called MANNOK U-value calculator, and it is shown in this website link: https://uvaluecalculator.mannokbuild.com/ . The main web page is shown in figure (1).

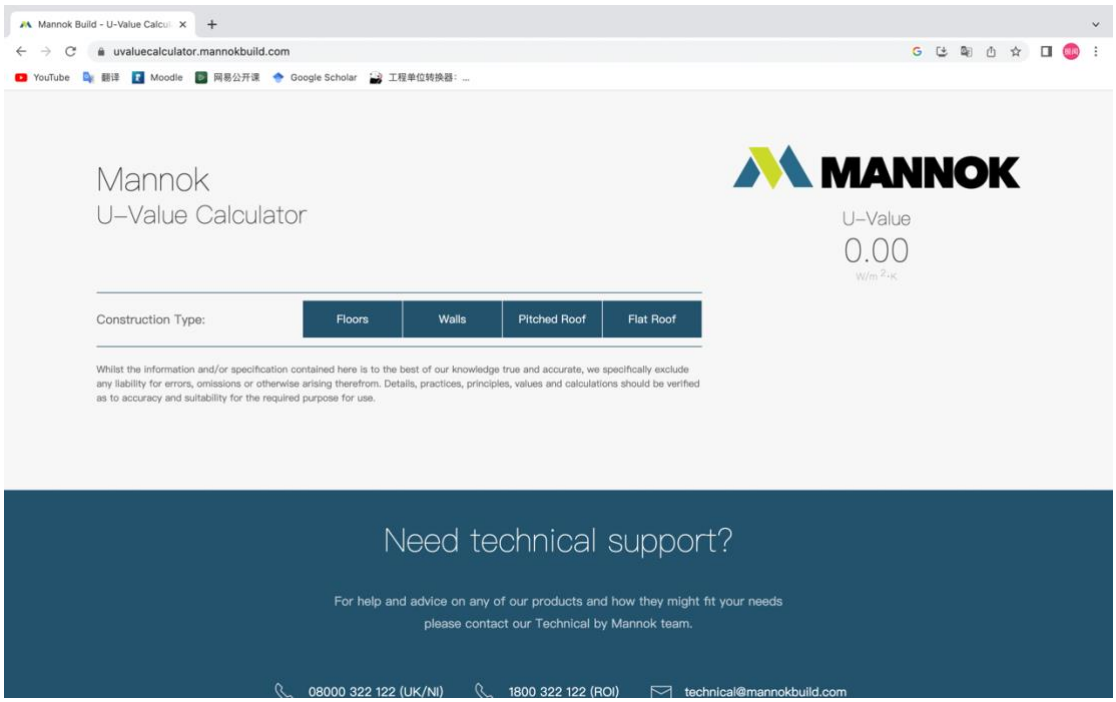

Figure (1).

Compared to the U-value calculator in our Practical Tools of Engineering, it can be found that MANNOK U-value Calculator has a better visual effect. Furthermore, MANNOK has classified by building structural types. There are four types, which are floors, walls, pitched roof and flat roof. Besides, under each type, MANNOK classifies them into more detailed types, just as the figures below shown:

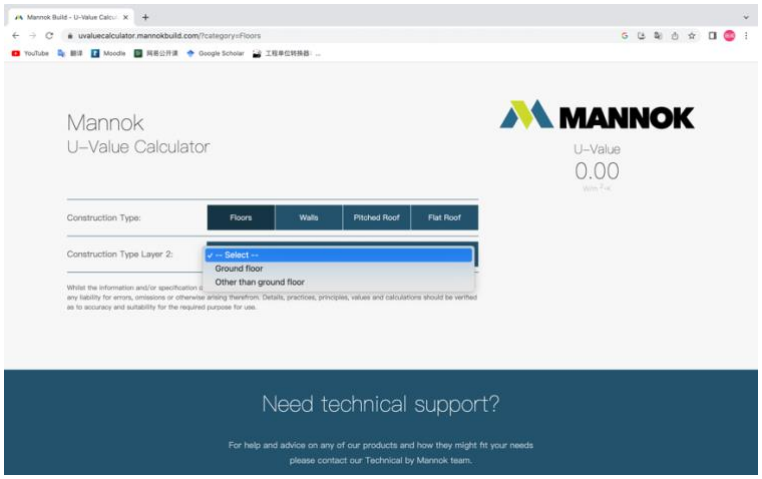

Figure (2).

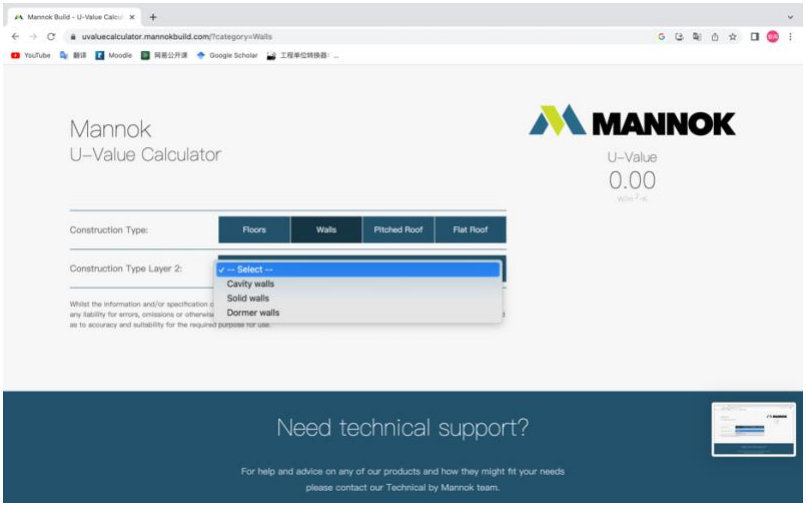

Figure (3).

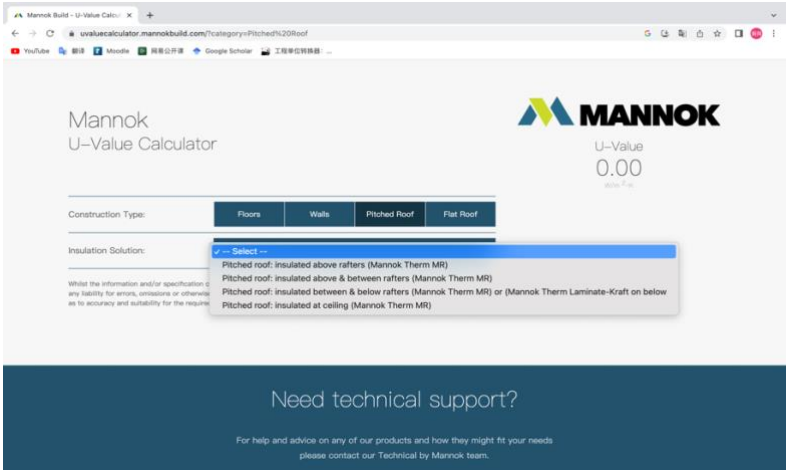

Figure (4).

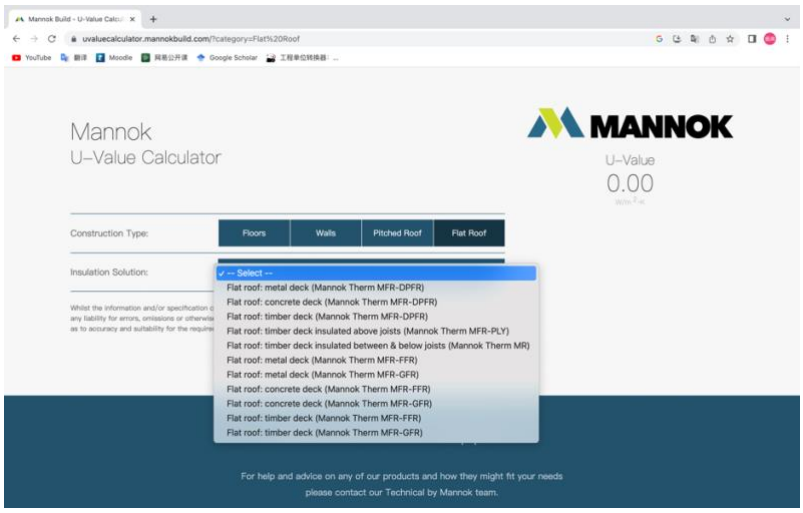

Figure (5).

However, it also has some disadvantages compared to our software. The most obvious one is that Practical tools of Engineering supports users to calculate structures which have several layers made of different materials, while MANNOK does not support that.

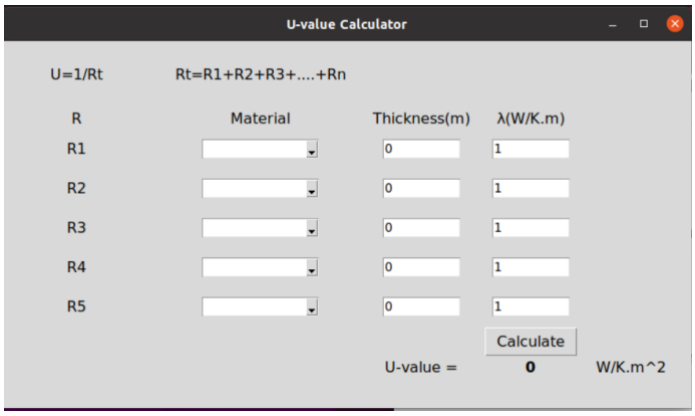

Figure (6).

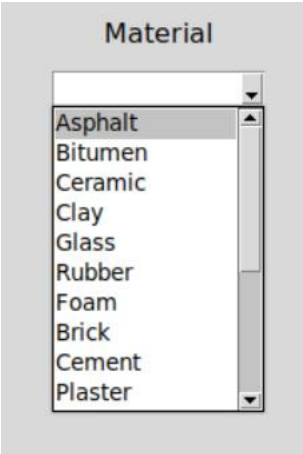

Figure (7).

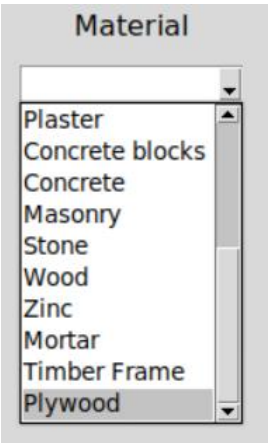

Figure (8).

An example of unit converter products is called Unit Converter Kit (https://unitconverterkit.com/). Its main page is shown in figure (9):

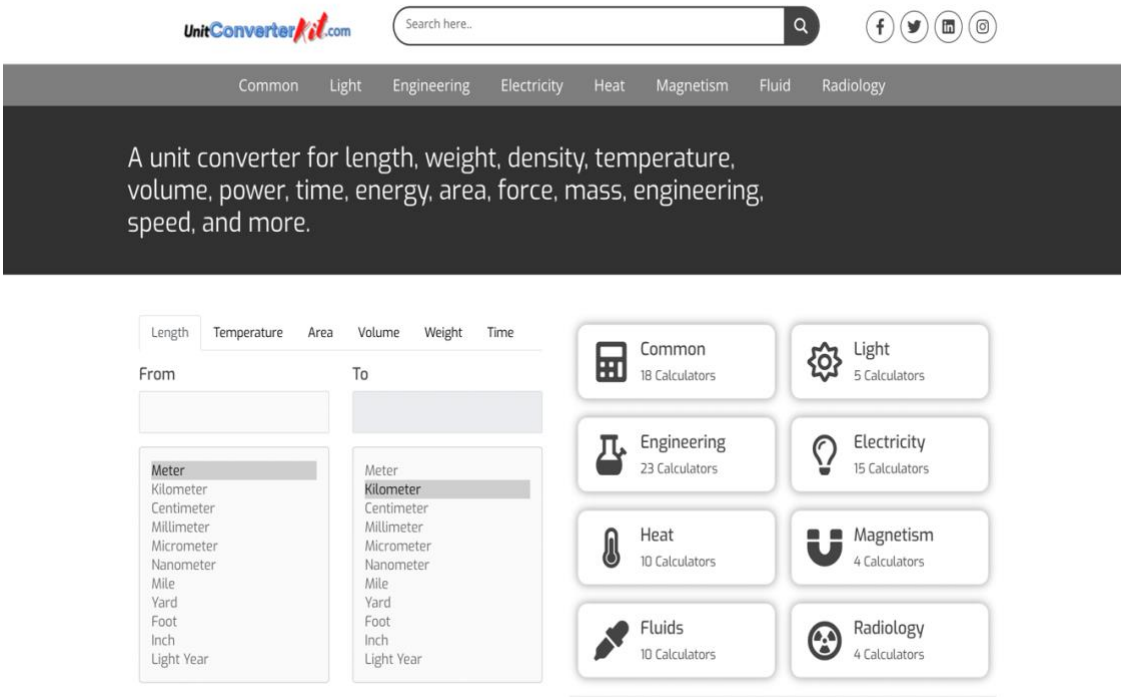

Figure (9).

Compared to our software, Unit Converter kit also has a better looking, and it supported more kinds of unit classes converter. Additionally, it is more convenient to operate the Unit Converter Kit, while users should choose the options in order when using Practical tools of Engineering.

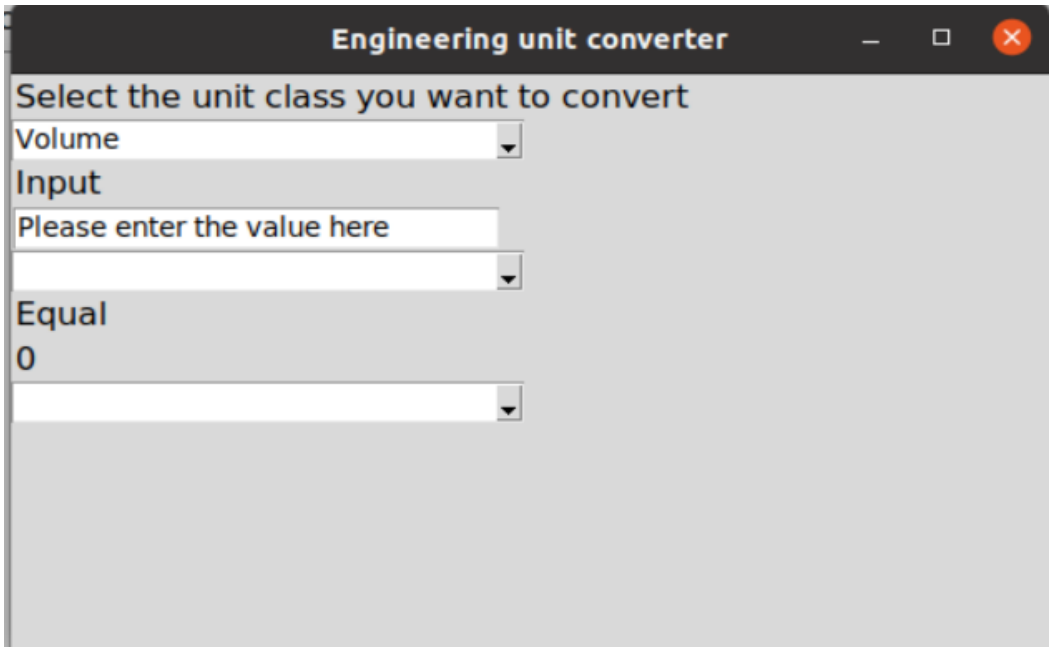
Engineering unit converter
Select the unit class you want to convert
Volume
Input
Please enter the value here
Equal
0

Figure (10).