# Background and Related Work

## Introduction

My software will convert a picture into a cross stitch pattern. The user will be able to edit the pattern and customize it using different features of the program. continue

## Cross Stitch

### **History and Basics**

Cross stitching is a type of embroidery stitch art (Setiabudi et al., 2017). A picture is created using colourful thread and little cross shaped stitches on fabric. Usually two strands of cotton thread are used (Dyer, 1997). The stitching is done on fabric that has small holes: aida or evenweave. The colour range of the threads can be vast, the most widely used is made by DMC. There are only a few types of stitches since the final result should look uniform. The simple cross is used most of the time, however a half stitch, quarter stitch, three-quarter stitch and backstitching is also used occasionally (Atkinson & Roberts, 1999).

A picture containing food, sushi

Description automatically generated

Figure 1 - example of a cross stitch on aida

This art-form originated in Asia, and the oldest cross stitch dates back to 850 B.C. It became more popular in the Victorian era. Then, in 1980 cross stitch re-emerged again, and became how we know it today. It is one of the most popular type of needlework throughout the world (Leslie, 2007). It is a soothing and therapeutic hobby, and could help improve mental health (Hohmann, 2020).

A pattern is needed to make a counted cross stitch. A pattern consists of a grid with colourful squares (Biedl et al., 2005). The squares signal the position and colour of the stitch (Atkinson & Roberts, 1999). The size of a pattern is measured by the number of stitches across and down.

Diagram

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Figure 2 - simple cross stitch pattern (Fitzgerald, 2017)

Diagram

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Figure 3 – The way a pattern is converted to stitches (Biedl et al., 2005)

### **Existing Software**

There are a number of cross stitch pattern making software on the market with varied quality and features. The most popular and advanced one is WinStitch/MacStitch (2019). This is a commercial software, and it is regularly updated. Another example is PC Stitch (2016), which was the preferred software until it stopped getting updates. Both can be quite expensive for a hobbyist, so a good alternative can be free, open-source software. These generally have less features and not as clean UI; however, they can still create a pattern. These include XStitch (Chestnut Pens, 2020) and CStitch (Klein, 2017).

All of the above software can convert a picture into a pattern. WinStitch has a wide range of features and a professional looking UI, so it is a good source of ideas for this project. Some features proving very useful are the ability to select the size of the pattern before generating it, as well as the number of colours used. These will be essential for this project too. Moreover, WinStitch uses real thread colours in the pattern, this makes it very practical for the user to buy supplies. There are also a lot of options to edit the pattern, from changing thread colours to drawing on it. The biggest differences between the free and commercial applications are the number of features the user interface. WinStitch’s UI is very sleek and intuitive, while CStitch’s is quite old looking and sometimes hard to use. I will aim to design an attractive UI with a good but not an overwhelming number of features. This way this project could be a good middle ground for users for a lower price but high quality.



Figure 4- Painting and cross stitch. Pattern created in WinStitch (Batho, 2014)

## Application Platforms

### .NET Framework

A suitable application platform needs to be selected for the software. This desktop application will be Windows based, so the Microsoft .NET Framework will be used. This technology supports running Windows and Web apps (Microsoft Docs., 2020). Both WPF and Windows Forms are part of the framework, however, they are best suited for different types of applications (Misra, 2016). Figure 5 illustrates the .NET stack.

Graphical user interface, application

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Figure 5 - .NET Framework

### Windows Forms

Windows Forms was released by Microsoft in 2002 as part of the .NET framework. This greatly influenced how Windows applications are written, explains Griffiths and Adams (2003). Before Windows Forms developers could only use Win32 to make Windows applications, this is lower level and does not have a GUI. By increasing the level of abstraction, a higher-level object-oriented API was created. This makes it much simpler to develop an application, allowing to concentrate on the task rather than the low-level details. In Visual Studio developers can make use of the Windows Form Designer, where they can drag and drop controls into the UI. WinForms is event driven, so when the user interacts with the interface, for example, clicking a button, an event occurs. The application processes these events with the help of event handlers, which are programmed in C# or other high-level languages (Microsoft Docs., 2017).

### WPF

WPF is a Graphical User Interface framework (Misra, 2016). It was released in 2006 with the new .NET 3.0 framework (Xu, 2010). The expectations for user interfaces were increasing, so new technology was needed, according to Nathan (2010). The user interface needed to be separated from the implementation, so that programmers and designers could work on the application without relying on one another. As an answer to this Microsoft released WPF. The user interface design is done in XAML, completely independent of the code. XAML is an XML based markup language designed for WPF (Microsoft Docs., 2016). This way the development is more efficient, and the cost is reduced. It is also easy to understand for designers. It is much more powerful than Windows Forms since it supports documents, multimedia, 2D and 3D graphics and animation (Xu, 2010). Before it would have required several different technologies to make an application containing all these. WPF is built on Direct3D, so it can provide high performance graphics.

In WinForms every control is defined in code, the graphics content cannot be separated.

### Comparison

## User Interface

### Another Subsection Title Rename Me

## Image manipulation

### Posterization

## Summary

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