Digital Art Capture (DAC): Software For System Control

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MSc Project Aim

- To design, develop and write 20,000 lines of computer program code incorporating feedback loops for real time control of a motorised mechanical and optical hardware system

Outline

1. System Requirements and Needs
2. Our Approach
3. Software Control
4. Demonstration of Results
5. Conclusions

An example of an iPhone Application

System Requirements and Needs:

- Need for art galleries to make a high resolution accurate precise image of an art work for archiving
  - If the art work is stolen, damaged by fire or water leakage or gradually ages due to ultraviolet exposure, humidity and temperature changes
  - the precision archived version can be used to conserve, clean and restore the art work to the original state.
- Need for art galleries and auction houses to identify the artist from precise details of the brush strokes

System Requirements and Needs:

- Need for art galleries to monitor the state of an art work during its life to monitor paint cracking and fading
- Need to digitise art works to put into an on-line picture library such as Tate Images
- Need to digitise hand made fabrics and wallpapers to show the structure of the weave of the fabric and the texture of the paper

Digital Art Capture

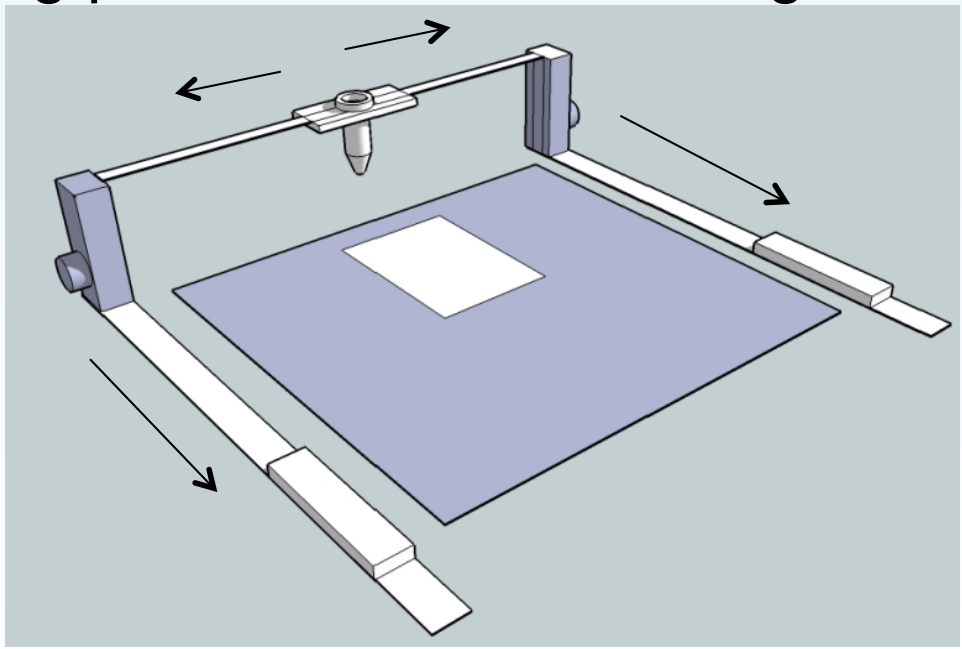
- Digital Art Capture (DAC) is a multidisciplinary pilot study to develop a low cost means to digitise two-dimensional artworks in the finest detail, particularly large scale works that cannot be readily captured at close range by standard digital photographic techniques.
- Art galleries, artists and art conservation departments will be able to use the DAC system to safely and easily record works such as paintings, drawings, prints and textiles to an extremely high resolution.

Digital Art Capture Project

- The project is funded by the UK Technology Strategy Board (TSB) and the partners are:
  - Electronic and Electrical Engineering, UCL
  - AutoEye Ltd
  - Northumbria University
  - Glasgow School of Art
  - Tate Gallery
  - The Henry Moore Foundation
  - Natasha Marshall Ltd.
  - Angela Flowers PLC

Our Approach

- To construct a system consisting of
  - A high resolution fast digital camera
  - A high quality lens system
  - A two dimensional scanning precision motorised stage
- A series of still photographs are taken and merged to form a single high resolution image



Software Control

- Each of the elements of the recording system must be controlled by real time software
- Several parts of the system have motors which cause movement of elements.
- The camera also requires control of its settings and transmission of data images from it to a local computer

Problems that had to be overcome:

- If the motors accelerate quickly to a high speed then they cannot decelerate fast enough so the motor will overshoot its position due to the mass and inertia of the stage and its components
- If the motor is not correctly controlled it always goes back to a zero position before moving to the desired position which wastes time.
- If the motor overshoots then it has to hunt back and forth in order to reach the correct position
- The accuracy of positioning is affected by the minimum step size that the motors can make.

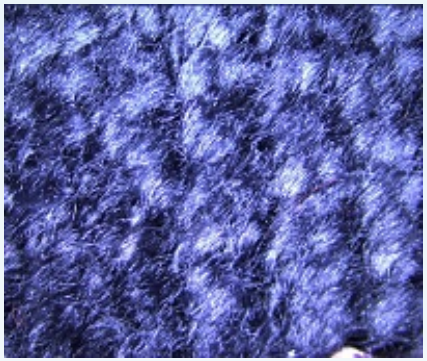
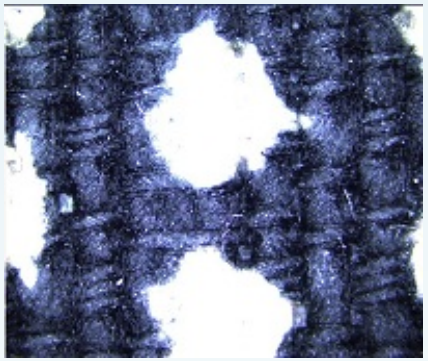
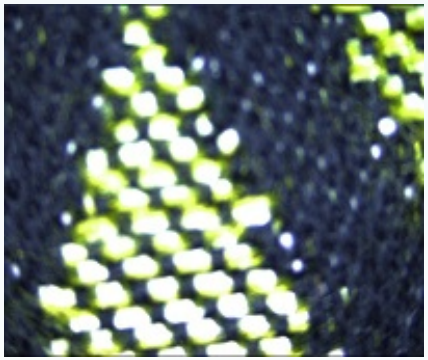
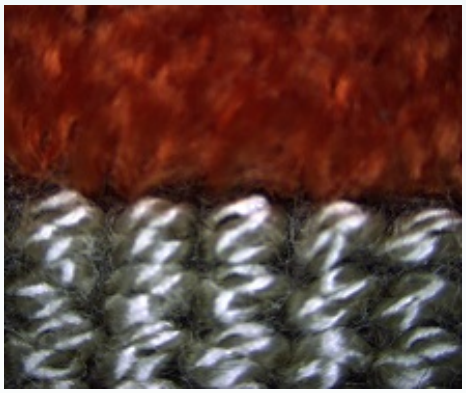
Problems that had to be overcome:

- The output communication of images from the camera to the datastore via an ethernet connection is too slow at 100 Mbit/s wheras the input data to the camera is 308 Mbit/s.
- A display function had to be implemented to show a real time image that is being captured by the camera – this requires a lot of computational capacity as each image is 14 Mbytes.
- Some algorithms had to be developed to give stable reproducible control of the hardware

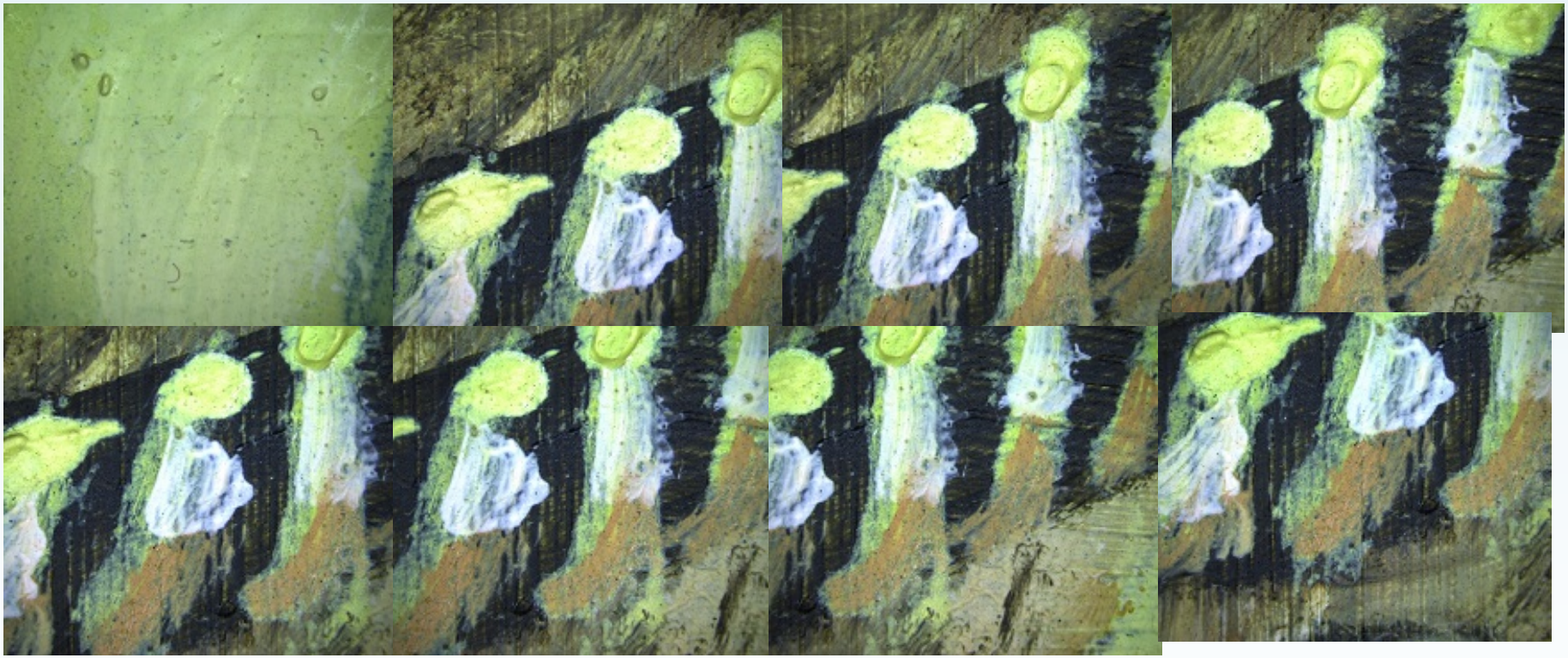
Achievements

- 20,000 lines of correctly operating computer program code were written to meet the requirements
- Multiple feedback loops were required for stable control involving feedback of the hardware system status
- Algorithms were developed to solve the problems just mentioned
- A Graphical User Interface (GUI) was written for overall user control of the software and hardware

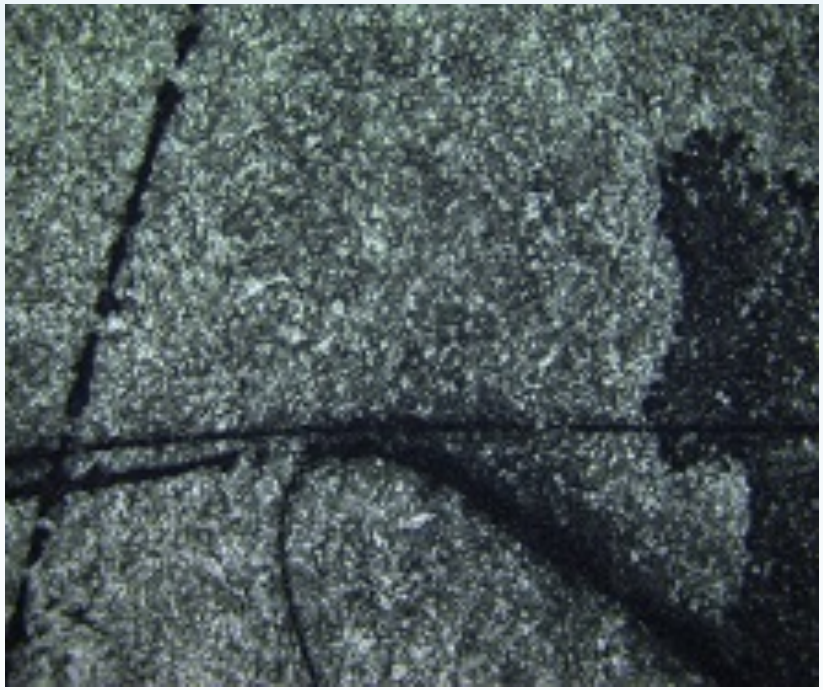
Examples of images recorded of Natasha Marshall Ltd Textiles

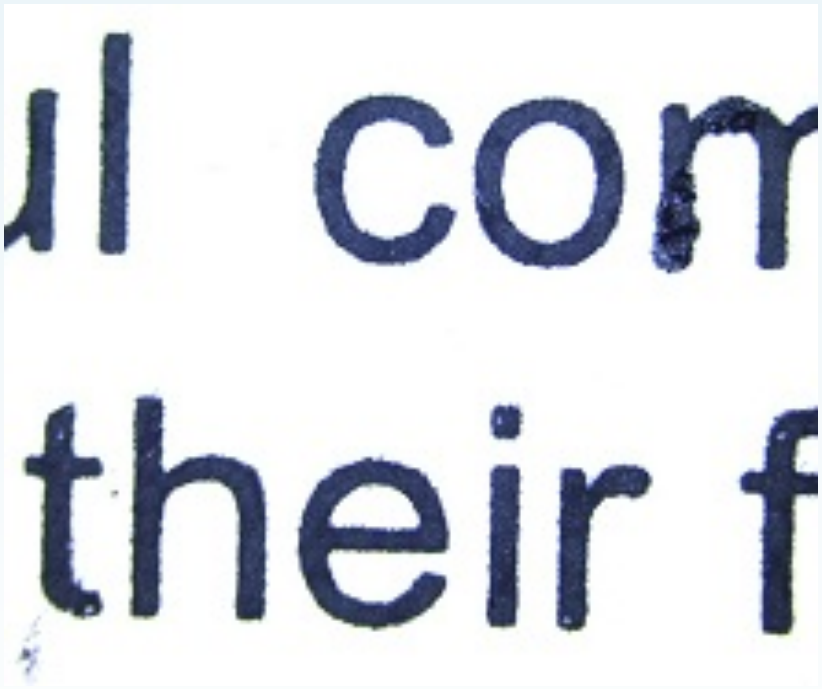







Examples of images recorded of Tate Joyce Townsend Oil Painting

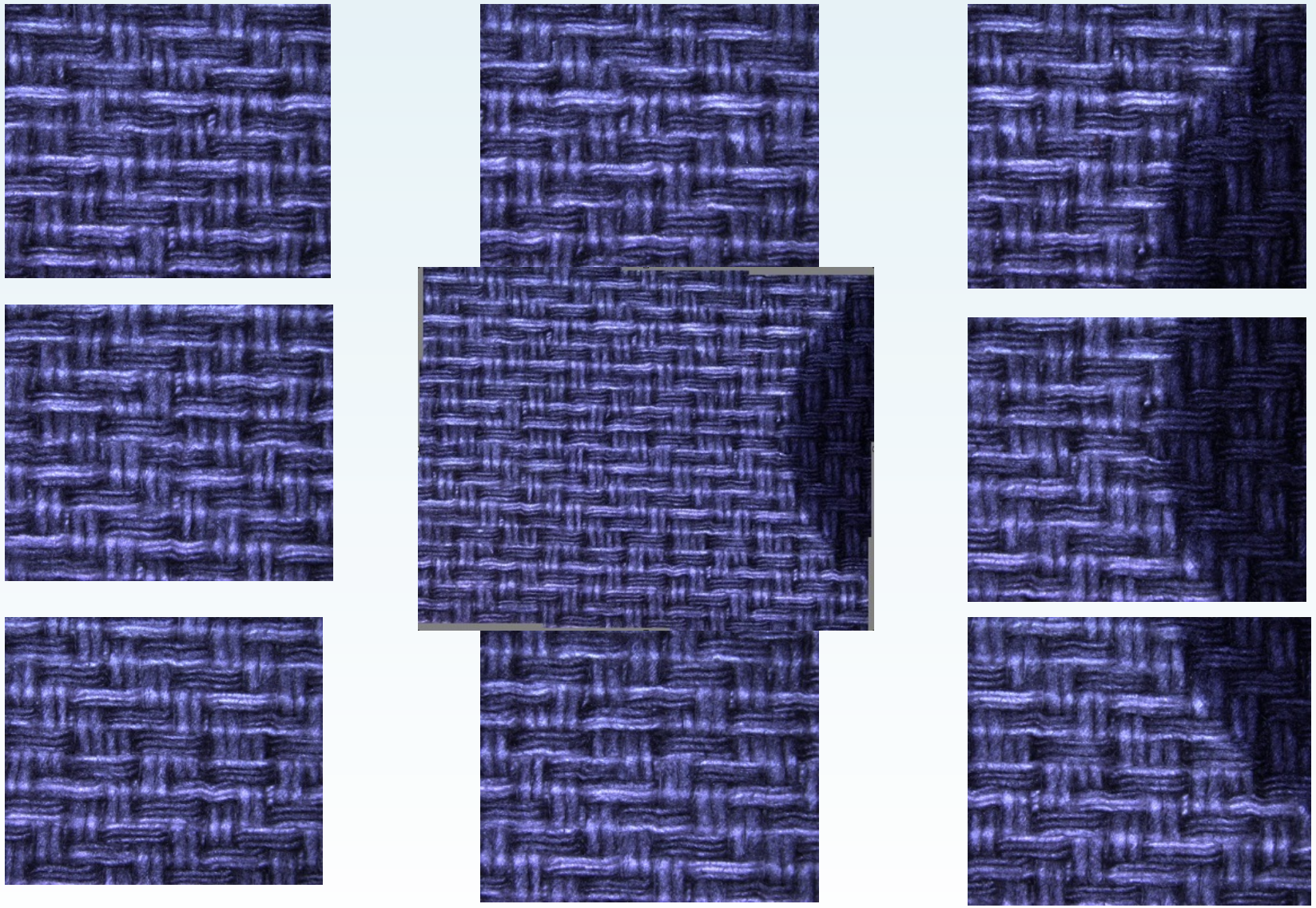


Examples of images recorded of an etching by Angela Geary, Northumbria University and inkjet printed text





Demonstration of Merging of 3 × 3 images



Conclusions

- Succeeded to design, develop and write 20,000 lines of computer program code incorporating feedback loops
- Demonstrated correct real time control of a motorised mechanical and optical hardware system

Thank you for your attention

Any Questions?