INCLUDE+ Pilot Report

Low-cost Subtitling and Audio Description for All.

Introduction

This project is primarily predicated on the community cinema experience. Currently mainstream and community cinemas have little to no accessibility to screenings that provide subtitles and /or audio description. The INCLUDE+ pilot initiative enabled an investigation into the potential of giving people a choice and improving inclusivity.

The pilot project included a practical approach to building a series of prototypes using a variety of delivery solutions and a level of testing and feedback via several focus groups to ascertain success and various failures.

The aim of the report is to highlight the evolution of the project from its initial concept stages to its user testing in front of an 80 strong audience within a typical community cinema setting.

Brief History

There are approximately 1,600 community cinemas in the UK alone. Oakwood Community Cinema in Leeds being one. It regularly screens a current film (once a month) to an average audience of 150+ people and has done for the past 10 years. Demographically, the audiences vary age wise, but the majority are older people. The genesis of this project came from a disgruntled member of the audience who complained about the clarity of the actors' voices and the hall acoustics one night. The acoustics to say the least, are not stellar, despite 5.1 surround sound being offered. Nonetheless particular voices and accents can be difficult to distinguish. As a result, a request for the subtitles to be switched on was made. The request was democratically put to a vote with the audience. Voting produced a 40-120 split in favour of NOT having them. It was later pointed out, by the disgruntled member that this is tantamount to discrimination, which is right and not acceptable. 40 people is a significant number though and represents 25% of the audience!

Objectives and Approach

The main goal of the INCLUDE+ pilot initiative was to help enable the development and building of a workable prototype and have it tested in front of an audience. What follows is that process.

Project fundamentals

The principle of the project is based on polarisation whereby LED monitors are partly depolarised by removing the plastic filter on the front of a monitor. This leads to a blank light grey screen. To view what's on the screen it is possible to use low-cost 3D glasses (£2-3 each) and repolarise the screen from a distance via these glasses. (See Fig 1 below).

Fig 1. Initial test.

There are various types of monitors on the market, but the lower end or older ones primarily use a screen that has a polarising plastic filter on the front. As mentioned, it is possible to carefully peel this off using white spirit and a thin blade. It's quite a time-consuming process, so not to scratch the glass below leaving it unaffected. But you are left with a blank grey bar area that is left clear if you don't have any specialist glasses. Hopefully not disturbing an audience during a screening.

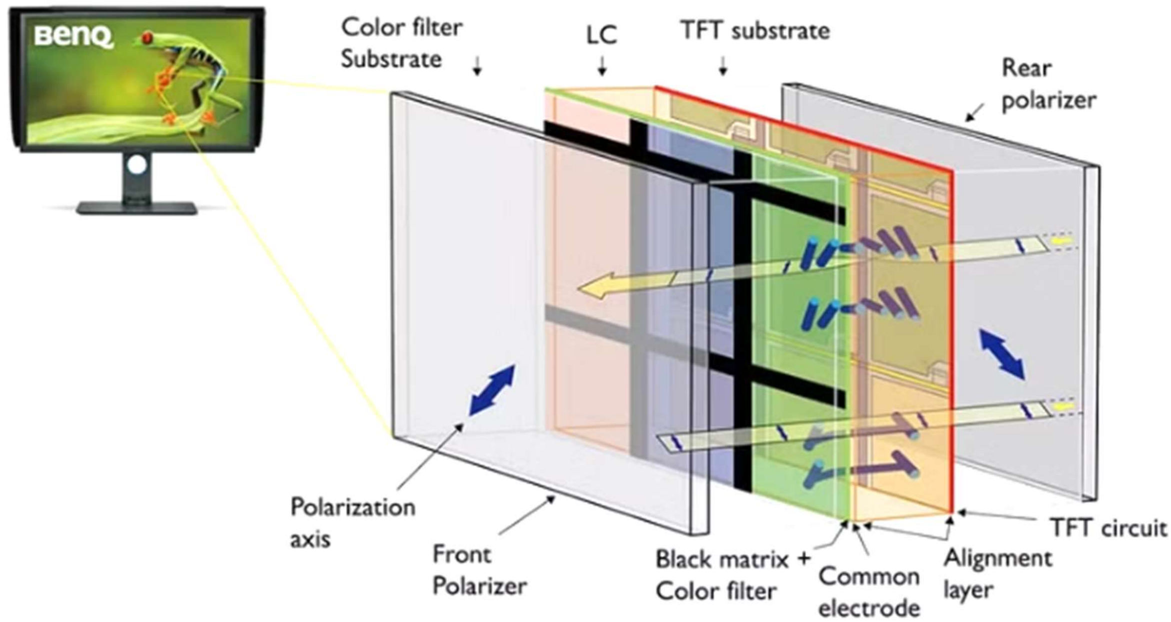

Fig 2. Panel Components.

The Glasses

The glasses used by an audience are low-cost 3D passive ones. As opposed to the active variety which are more expensive. Although these also work.

Whist researching it became apparent that several options are available that enable the use of subtitles but in a different way and separate to a screening. These use a more augmented reality approach (AR) but are by far too expensive for community cinemas. As an example, the national theatre in London offers the Epson Smart Caption glasses. E.g. Moverio BT-350.

Another solution is Watchword CC by BFG Ltd*. Both these solutions are approximately £500 per pair. However, it is also necessary to buy a server *£3-£6K depending on the venue size and an annual subscription costing *£330. Plus £500 for installation. (All Ex VAT).

Fig 3. Watchword Glasses with handset

The priority for community cinema is cost and ensuring that there would be enough to go round if required. Glasses for the project are approximately £2-3 per pair for the frames. The replacement polarising lenses are cut from an A4 sheet (£7.50 per sheet). Each sheet produces approximately 12 replacement lenses. The critical factor in cutting out the new lenses is the orientation of the sheet to the monitor. Testing prior to cutting is recommended.

Fig 4. Low-cost 3D Passive glasses.

Preparation and Extraction of Subtitles

The films being screened and the subtitles on the monitors are separate. It means that both need to be synchronised. Each open captioned film has an *.srt file (or the like) created for it. Creating subtitles is an extremely nuanced and specialist job, especially for translators as the simplest inflection or wrong word could change the context of a scene. An *.srt file (a text-based format used for subtitling) can be extracted from a DVD or Blu-Ray or downloaded from an online source. However, with reference to the latter there is no guarantee that the subtitles are correct for that version of the film.

Method One. There are several sites available to download subtitles for free. These sites offer various versions and different languages. Although the easiest method, it can be frustrating wading through a list to find the correct subtitle format. Lots of films are distributed at different frame rates. In the UK we use 25fps, the US uses 30fps. Films are generally 24fps. Any discrepancy in the wrong selection can result in the subtitles drifting out of sync as a result. It is possible though to use the Open Subtitles website. Although in beta phase the site allows you to drag and drop your digital movie file into a box. This will then compare your movie file against its database and hopefully give access to the correct subtitles for that copy of the film. *https://www.opensubtitles.com/en/home*

Method Two. This method uses professional video editing software. Blackmagic Design's - Da Vinic Resolve 20.2 is free. This can create subtitles automatically from a film. It takes approximately 10-15 minutes for a 2-hour film. The results are remarkable, but the method is not infallible. Some checking and correcting are necessary which adds to the preparation time. However, there is complete freedom in constructing the subtitles. It's possible to change the font size, colour, position and background including transparency. Convention dictates that 42 characters should be allowed for a single line of subtitles. These can be doubled up to 84 on two lines. But as mentioned, the downside of this method is that each caption needs to be checked and altered to ensure that what is being said is accurate and well timed.

Method Three. This method is a bit of a cheat but accurate. Using the same software as above (Resolve 20.2) it is possible to colour correct the subtitles. By switching the subtitles on, on a film the area at the bottom of the screen can be cropped out. The editing software enables complete colour correction control of every frame in a film. Technically the process is pretty straightforward. By adjusting the colour saturation to black and white and modifying the contrast up and down the resulting image creates a readable subtitle track. It's not a perfect solution but does save a lot of preparation time and is guaranteed to be accurate.

The most important factor though using any of the methods above is that a video file e.g. an H264 MP4 is created and exported. This video file is prepared alongside the main film to ensure that there is exact registration between both when screened.

Projecting the Subtitles - Font Size

For the project some additional research was done to ascertain the necessary font size that would be necessary for the audience viewing of the monitors. Ergonomically there is an equation that can be used to ensure that audience members at the back of a room, fifteen meters for example away can read the subtitles. This works out at 0.0058 x 15000mm = 87mm. This means the text needs to be approximately 200pt-248point size based on the size of a 34” Ultra-wide computer monitor. (at 42 characters per line).

Syncing the Subtitles

This has been one of the most challenging parts of the project. Ensuring that the subtitles are correctly lined up with the film being screened. It soon became apparent that to obtain frame accuracy a ‘one button’ approach would be necessary. Whereby all digital files set off at the same time.

Method One – *Digital Signage*

This method uses a Content Management System (CMS). It utilises hardware in the form of screens, interactive kiosks, video walls, projectors or monitors. Software is required to set up content. A stable Wi-Fi connection is also required as the system broadcasts its information. It also requires a media player to be connected. This project used Raspberry Pi 5’s to serve this purpose as a low-cost method to link the movie screen and subtitle screen(s) together. Several solutions were tested. Optisigns and Yodeck to name a few. These work on a subscription basis. Both are in the realms of affordability. E.g £7 per screen, per month. Two screens are necessary. Whilst evaluating this method a secure Wi-Fi network was crucial. However, as each screen uses its own Raspberry Pi 5, content is downloaded first and then broadcast to prevent interruption.

Method Two – *Creating a script / app.*

Through various discussions with colleagues from the Helix, and as an alternative to the previous method. A student software engineer (Gyanateet Dutta) was engaged to help code some script for an app for the Raspberry Pi's. The apps' main purpose was to synch all files. What sounded like an easy task wasn't. The solution was to use two iterations of the VLC software (media player app). But it worked.

```
"
#!/bin/bash

# Path to the media files   to play
MEDIA_FILE1="/path/to/your/media1.mp4"
MEDIA_FILE2="/path/to/your/media2.mp4"

# Open the first instance of VLC
vlc "$MEDIA_FILE1" &

# Open the second instance of VLC
vlc "$MEDIA_FILE2" &

# Wait for both instances to finish (
wait
"
```

Fig 5. Script coding by Gyanateet Dutta.

Method Three. - ***Isadora***

After researching numerous other options, it was decided to invest in some third-party software called Isadora. (Isadora 4 by the German company Troikatronix). This is specialist software for visual programming. It is used quite extensively within the arts sector primarily in theatres and clubs for VJing (Video Jockey). Its purpose is to accurately cue lights, music, sound effects and of course video. It's not that expensive for community cinemas to buy outright at £665 or license for £182.50 per year or even rent it. (7 Days £16.04 or 30 days £27.52). This gives community cinemas a lot of scope. Programming the software was a steep learning curve. But it offers synchronised playback of video and audio at the same time. This means audio description can also be included.

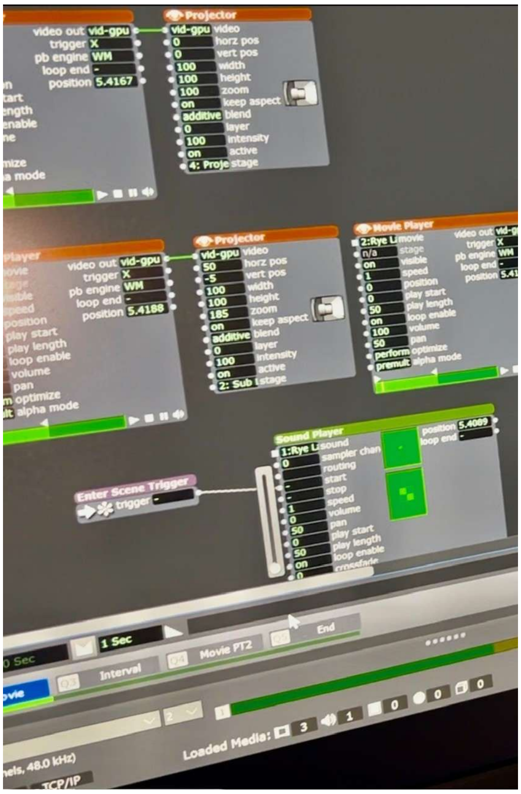

Fig 6. Isador node-based software.

Prototype v3

Using Isadora software and purchasing four identical monitors meant that a much larger prototype could be constructed. Synchronising several monitors meant that a complete evening's screening could now be achieved by the press of one button. It also makes it possible to run the subtitles across two monitors side by side. The subtitle digital file (MP4) can be imported twice. Each file can be enlarged and positioned so there is a left half and a right half. (See Fig. 6 Below). This increases the viewing possibilities with larger text. In addition, the audio description can be also synchronised to run at the same time.

Fig 7. Subtitles across two screens.

Audio description testing.

Using prototype v3 it was possible to broadcast the signal via Bluetooth. This can be picked up by wireless headphones and works well. However, to be properly functional and reach as many audience members as require it would be necessary to obtain a Bluetooth transmitter. This then works like a silent disco.

User Testing

Focus Group One – Oakwood Cinema, Leeds.

The first INCLUDE+ focus group was, held on 20th August 24, and was set up 45 minutes prior to the Oakwood Cinema screening. The session was very much about discovery for the participants. Sadly, the audio description didn't work but the Subtitling solution did.

The focus group revealed two key points from discussion.

> *'Sitting at an acute angle to the monitors means you can see the text without glasses.*
>
> *'Screens aren't bright enough'.*

The first focus group revealed a flaw that needed to be addressed. The system relied on an external lighting source to illuminate the back of the screens. This wasn't ideal and a new direction meant finding a better solution. It was quickly realised that the backlight of a monitor is more than adequate. However the LED light(s) are only partially dimmable. It was a potential problem that might be distracting for an audience. More audience testing was necessary.

Focus Group Two – Pix in the Stix, East Linton, Scotland.

The second INCLUDE+ focus group was conducted on Friday 22nd November 2024 in Scotland. Pix in the Stix is a well-established community cinema in East Linton near Edinburgh. They helped Oakwood Cinema get started back in 2015. This event was primarily delivered to the Pix committee members to ascertain whether they would be interested in adopting the system. Prototype v2 was used for the focus group as it was a lot simpler and had been rationalised for a more portable approach. The principle remained the same. The top monitor (See fig 8 below) was connected to a normal desktop TV / monitor mount. This served as the main projection screen. The screen below was letterboxed to enable the reading of the subtitles but helped to block out part of the screen so it remained black. This set up used Raspberry Pi 5's as the video displays using the digital signage method. Technically it would be possible have any monitor, anywhere in the world operating provided there is a Wi-Fi connection and the correct software and code attached to it.

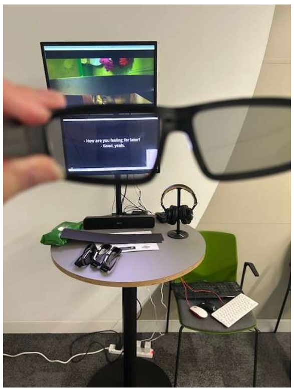

Fig 8. Prototype v2 at the INCLUDE+ Conference Sept 2024.

Fig 9. Pix in the Stix with glasses

The committee were intrigued by the solution and feedback was very positive. They didn't necessarily place an order, but they are currently seeking funding to pay for their own equipment to utilise the solution once the project has concluded.

Focus Group Three – Pix in the Stix, East Linton, Scotland.

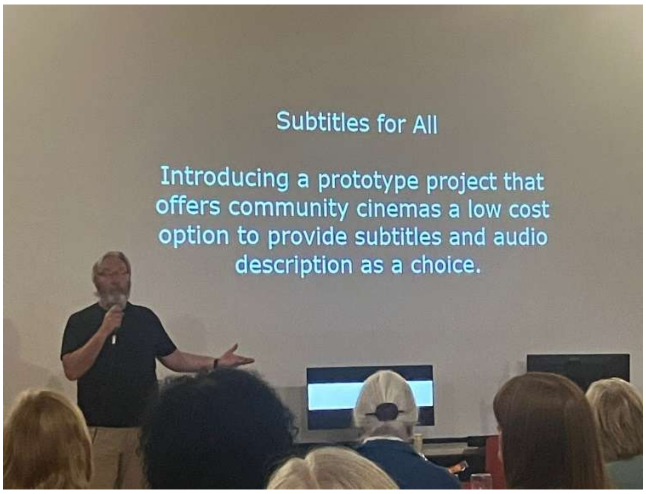

Fig.10 Pix in Stix 80+ Audience

Fig.11 Presenting the concept

The third focus group was held on Saturday 21st June 2025, it marked a pivotal moment in the INCLUDE+ journey as it was the first time the new update prototype v3 had been used in front of a large audience. This session provided a unique opportunity to evaluate the prototypes strengths and identify areas for improvement. A questionnaire was designed to tease out issues and get some more detailed feedback on the system. Demographically a Pix audience is very much like an Oakwood cinema audience with very few youngsters (less than 50yrs old). Nonetheless the feedback was both encouraging and constructive. Twenty sets of glasses were handed out along with the questionnaires. Participants were shown a short film. 19/20 responded.

Notable responses

Section 3: Subtitle Usage.

Why do you use subtitles?

- ❑ To understand foreign languages - 13

- ❑ To follow dialogue better - 11
- ❑ For learning a Language - 1
- ❑ Because of audio issues or hearing impairment - 4
- ❑ Out of habit - 0

Section 5: Subtitle Monitor (viewing without glasses on).

Did you find the white bar distracting while watching the short film -

- ❑ Yes, very distracting – 2
- ❑ No, not at all - 14

Additional Feedback – Comments or Suggestions.

'The subtitle box needs to be a bigger ratio to the screen'
'No Subtitles'
'A bigger (as in wider) screen would help'
'It would be better if they appeared on the screen'
'It worked very well for me'

Thoughts

It's appreciated that this is a small sample, but it was interesting that 15 participants use subtitles to improve their understanding of dialogue. A lot use subtitles on their TVs at home. It was also surprising that 14 participants <u>weren't</u> distracted by the white bar on the monitor when the glasses were left off. In retrospect audiences are probably accustomed to having low light sources in a cinema e.g Exit signage and low-level step lighting.

Conclusions

Gaining support from the INCLUDE+ project has certainly moved the project onto the next level. Gleaning information from the focus groups has helped crystalise the faith that this is a potential low-cost solution for community cinema audiences. Hopefully one that could be adopted and make a journey to the cinema a truly inclusive and accessible experience for all people.

Moving forward, the recent INCLUDE+ conference (18th September 2025) has helped galvanise an approach. It was suggested that the report could form part of a 'how to' publication in conjunction with Cinema for All in Sheffield which supports the 1,600 community cinemas around the country. (Cinema for All is primarily funded by the British Film Institute BFI via National lottery funding and memberships).

There do remain a few caveats though before a roll out. The main one being procurement of the digital movie file and the extraction of the *.srt subtitle files and audio description. The main factor though is that there isn't any copyright infringement used in the process.

This journey has been really, really enlightening and shows that there are a lot of people out there who are struggling to enjoy cinema. With some more backing a next gen will be possible.

Future Developments

- Focus Group Four – Oakwood Cinema, Leeds. This is planned for the next film which is on Saturday 25th October 2025. This will be another opportunity to use prototype v3 but with two monitors. Thereby extending the view from further away.

- There is scope to develop a new approach using Ultraviolet projection using black light. This would still involve using 3D glasses but doing away with the monitor approach. Ultraviolet light is outside of the visual spectrum so audiences without the glasses would not be able to see the subtitles. Professor Gordon Love from the School of Computing (UoL) is an advocate of the project and will hopefully be involved in this new direction.

- Sara Magro Ramos Pinto and Carlo Eugeni from the School of Languages Cultures and Societies (UoL) are keen to develop a research bid engaging with innovation in subtitling. They are keen to involve the Subtitles for All project.

- Bigger screens are a priority. One route to explore is use of advertising displays which use monitor technology but are made to measure.

Thank you for reading.

References

https://www.makeuseof.com/tn-vs-ips-vs-va-best-display-panel-technology/