Replacing Video Cameras With Mobile Phones Using the Multi-Phone Livestreaming (MultPLS) Method

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Abstract
Livestreaming has become the new normal for universities. It is common nowadays for academic events such as webinars and conferences to be streamed live to a global audience. A conventional livestreaming session typically utilises multicamera production (MCP) to achieve varied and dynamic video angles. This kind of footage is crucial for the audience to fully appreciate the event; however, it requires video production cameras, which presents constraints due to the cameras' lack of flexibility, high costs, and necessary usage training. Our study aims to overcome these challenges by 1) emulating the MCP livestream quality using a simple, flexible, and sustainable approach; and 2) optimising the use of existing equipment to minimise financial needs. We devised the Multi-Phone Livestreaming (MultPLS) method, an innovation that uses mobile phones in place of video production cameras, with its own plug-and-play Wi-Fi access point to produce an isolated network for the mobile phones. MultPLS was repeatedly tested and evaluated in various academic events over 21 months. We discovered that MultPLS held advantages over the conventional method. In terms of footage quality, MultPLS is equal to or better than the conventional MCP. MultPLS is more flexible when it comes to physical and location movements. It is also more economically sustainable. Finally, this method can be utilised for livestreams from any locations with internet connection, thus cancelling the need for outdoor broadcasting vehicles. We are therefore confident that MultPLS possesses great potential for applications in the academic domain and beyond.

Keywords: Multi-Camera Production, Mobile Phones, Livestreaming, Internet

Background

The COVID-19 pandemic in 2020 triggered an avalanche of impacts that resonates around the world. In the tertiary education domain, this culminates in a forced leverage of existing technology to continue academic activities. One approach is to go hybrid, that is, to combine both virtual and face-to-face settings in one event. To allow participation from a bigger pool of audience, hybrid events are also livestreamed.

Livestreaming is the simultaneous real-time recording and broadcasting of media to online viewers (*Netnography unlimited*, n.d.), typically including a two-way instantaneous communication between the broadcaster and the audience or amongst the audience themselves through the engagement mechanisms of the platform. Catalysed by the pandemic, livestreaming has grown in popularity and has been used for a variety of purposes, including branding (Haushalter et al., 2022), teaching and learning (Jin, 2020; Mill et al., 2021), and conferences (Overbay, Bigand, & Springer, 2021).

The use of livestreaming as part of a branding exercise has been shown to increase positive viewer engagement, with a persisting effect even after the campaign has been completed (Haushalter et al., 2022). In terms of teaching and learning activities, livestreaming is viewed as an alternative and viable approach (Chen, Chen, Wang, & Huang, 2022; Nurain Adila Abdul Samat et al., 2019). It has been proposed as a more interactive method compared to pre-recorded videos (Faiz, Marar, Kamel, & Vance, 2021). In medical education, livestreamed remote ward rounds received favourable responses from the students, instructors, and patients (Mill et al., 2021). Even if conventional teaching and learning approach may return, livestream provides a promising alternative in contexts such as global education and teaching in remote areas or as an add-on method for educational purposes (Faiz et al., 2021).

In academic conferences, livestreaming is also viewed positively. Feedback from a medical research conference showed that the participants perceived livestreaming favourably due to three main benefits: cost saving, self-care and safety, and user-friendliness (Overbay, Bigand, & Springer, 2021). Despite the lack of face-to-face interactions, conferences that utilise livestreaming from multiple locations around the world possess striking advantages, i.e., increased inclusivity and equity (participants from all around the world have the opportunity to join) and reduction of climate-damaging emissions (due to travels) (Parncutt, Meyer-Kahlen, & Sattmann, 2019).

The challenges of event livestreaming

Livestream broadcasters share one primary goal: audience engagement. To get and maintain audience engagement, livestreams need to be done in a way that keeps audience entertained (Fraser, Kim, Thornsberry, Klemmer, & Dontcheva, 2019). A livestream that can show how an event unfolds in real-time may be able to capture audience attention better. Real-time interactions such as chats and comments between the broadcaster and the viewers also heightens the sense of virtual community of the livestreaming audience (He, Yao, Tang, & Ma, 2022).

To achieve these, especially for event or programme livestreaming that involves a lot of movements or different locations, a single camera would not be sufficient to capture different moments. This is where livestreams are conventionally conducted using a few video

production cameras. More than one video production camera is typically required for events such as a graduation ceremony, launching of a programme, or even an interactive seminar. The footage from each video production camera will be fed into a video switcher, usually via cables. The video switcher will allow the person in charge to select which videos to be streamed online. Some video switchers can stream video directly, whilst some would need to be connected to a computer. Shown in Figure 1 is the configuration for a conventional multicamera production (MCP).

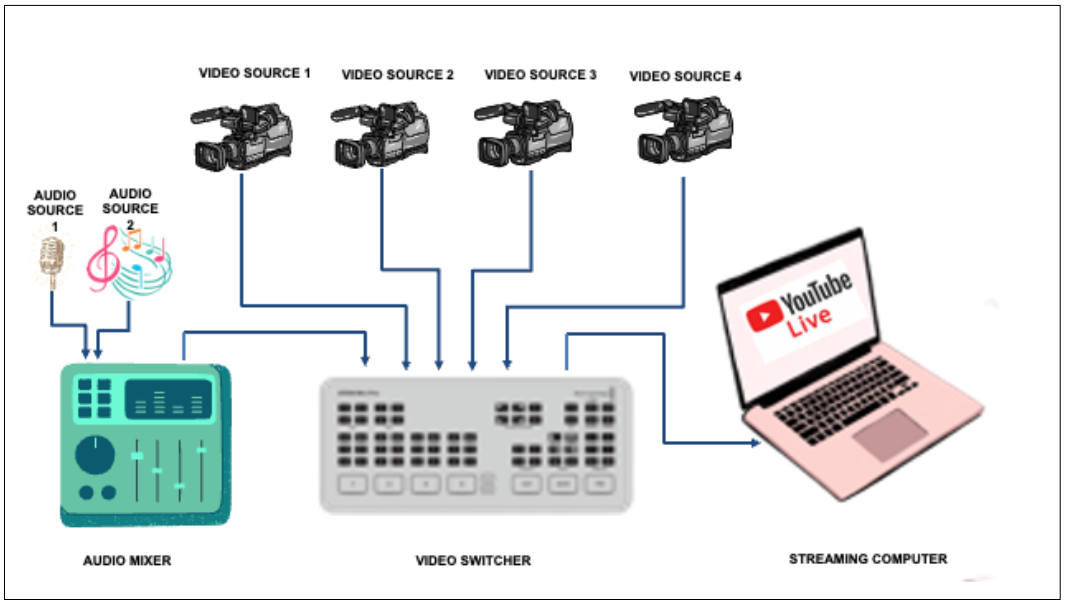


Figure 1: A conventional MCP livestreaming setup with video production cameras

To achieve this, however, some challenges have to be addressed.

First is the limited quantity of video production cameras owned by the institution. Video production cameras are expensive. To form an MCP setup, more than one video production cameras are needed, which means that multiple purchases are required.

Second is the limited expertise regarding the use and maintenance of video production cameras. Training is needed to optimise the usage of the cameras. This requires time and manpower. In addition to this, we would also need the appropriate technical skillset for the proper maintenance of the cameras. Failure to do so would be a waste of purchase in that the usage is not optimised.

Third, even if the first two obstacles have been overcome, there is still the challenge of limited flexibility. Video production cameras are connected to cables unless a wireless HDMI device is readily available. In addition, this type of camera is quite heavy to be lugged around, especially when covering dynamic events. One possible solution is to use motorised conference cameras, but motorised conference cameras also need to be connected to a USB and power cables. Moreover, despite having a motor to rotate the camera view, the speed of a motorised camera is slow, thus restricting it to a limited number of event activities. Overusing the camera rotation would result in a low-quality video footage.

Finally, events or programmes in remote areas (e.g., community service in rural villages, research expeditions) cannot be livestreamed without the technical equipment to support the

video feeds from the video production camera. This necessitates extra luggage, or for major events, the rent of an outdoor broadcasting vehicle (OBV).

We therefore faced the options of purchasing new video production cameras and then to get experts to train our team to use and maintain these, or to let university events be livestreamed using the current limited setup, i.e., using a single video production camera or paired with a motorised conference camera, or paying external teams to livestream events, with the hopes that things will return to normal. But we chose a third option – innovate so that there is no need for acquisition of expensive equipment and at the same time, achieve high-quality livestreaming. This paper will compare the viability of mobile (smart) phones as part of MCP against video production cameras only as MCP in terms of video quality, video angles, multiple filming locations, and financial sustainability.

Methodology

The investigation for this study took place in the form of an action research. The study started with research on the existing issue and challenges, illustrated in Figure 2.

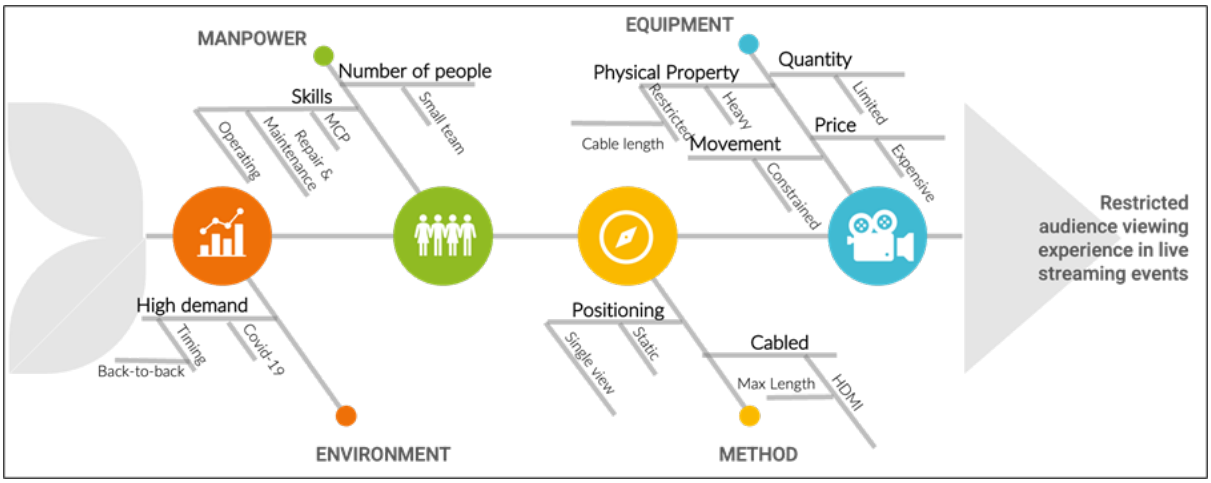


Figure 2: The Ishikawa Method used to encapsulate issues and challenges

We conducted action research throughout 2021-2022. We repeated the action, evaluation, and critical analysis of practices based on the data that we collected during the exercise. Each of our "tests" took place during specific events in the university. Following Byrne (2005), the position of researcher and practitioner should be a contextual rather than a fixed concept, which means that in this study, we played both the parts of the researcher and the practitioner.

We started with one mobile phone to complement one video production camera. In the following setups, we increased the number of mobile phones and added components such as gimbal to stabilise the recording.

The configuration of MultPLS is as follows:

1. Events are filmed by mobile phones (therefore taking over the video production camera's role).
2. Videos from mobile phones are transmitted to a host computer or laptop that acts as a video switcher. This is done via a specially set up local area network (LAN).
3. As mobile phones and computers can be equipped with open-source software for livestreaming and video recording (i.e., OBS), the video feeds can be sent directly

from the mobile phones to the computer/laptop without the need for a video switcher as an added equipment.

4. The person in charge (Stream Director) views all videos before selecting and tailoring them for the live broadcast to selected platform(s) (e.g., Facebook, YouTube, Zoom, etc.)

To ensure smooth and uninterrupted data transfer over the LAN, the team created an exclusive plug-and-play wi-fi access point (AP) for all devices involved. This exclusive access means that the bandwidth will not be affected by other users in the same compound and has the added value of security.

MultPLS was first used in January 2021. As of December 2022, we have utilised MultPLS in 88 university events. Table 1 shows selected events, dates, and the progression of MultPLS over approximately two years.

Date	Event	Items	Notes
12 Jan 2021	Borneo Leadership Talk Series 1/2021	1 mobile phone 1 production camera	One camera angle for speaker, one for audience. Video from mobile phone was shaky at times
18 Feb 2021	*Amanat Naib Canselor*	1 mobile phone 1 production camera 1 gimbal	Gimbal adds to mobile phone stability in dynamic shots
17 Mar 2021	*Majlis Anugerah Gemilang UNIMAS*	2 mobile phones 1 production video camera 1 gimbal	3 angles, with 1 phone roaming around
22 Jan 2022	*Majlis Lafaz Pengisytiharan Pentauliahan dan Pemakaian Pangkat* PALAPES	3 mobile phones 1 production video camera 1 gimbal Cross live broadcast – VVIPs arrival, 1km from the main event	4 angles with one from a satellite location, capturing the arrival of guests
20 Aug 2022	*Jelajah Puisi Keluarga Malaysia 2022*	3 mobile phones, 1 production video camera, Gigabit router	Smoother video, due to faster transmission of videos over the local network
4 Nov 2022	*UNIMAS Business School Graduation Ceremony*	3 mobile phones, 1 production video camera, Gigabit router	Offers variation from the usual graduation ceremony because one roaming mobile phone was used to film the VIP procession

Table 1: The progression of MultPLS over two years

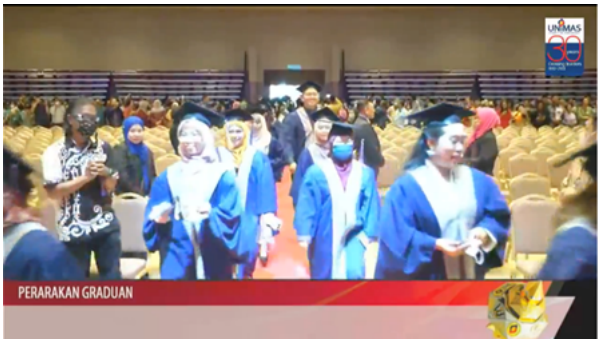
Findings

In this paper, we present our findings from the comparison on the use of MultPLS as opposed to conventional MCP for livestreaming university events.

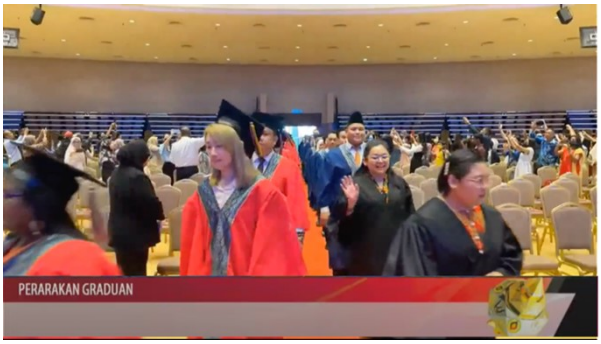
Comparable quality of video

Based on our comparison, we found that videos from mobile phones versus videos from video production cameras were comparable in terms of their sharpness, colour composition, and lighting. These were true for both indoor and outdoor events. As most mobile phones nowadays can capture videos of at least 720p, the pixel quality from mobile phones is also similar to the pixel quality from video production cameras. More expensive range of mobile phones that encompass the latest technological advances also offer wide angle and optical zoom options, which means potentially better video quality.

The following images show snapshots taken from a video production camera and a mobile phone. Figure 3 is a comparison for an indoor event and Figure 4 is a comparison for an outdoor event.



Still from a VPC (Panasonic AJ-PX270EJ, 720p @30fps)



Still from a mobile phone (iPhone X, 720p @30fps)

Figure 3: Comparison of stills from a VPC and a mobile phone (indoor event)

Still from a VPC (Panasonic AJ-PX270EJ, 720p @30fps)

Still from a mobile phone (iPhone X, 720p @30fps)

Figure 4. Comparison of stills from a VPC and a mobile phone (outdoor event)

Easy addition of video angles and add-on livestreaming features

Due to the lighter weight of mobile phones compared to video production cameras, it is more convenient to bring more mobile phones to any particular event's setting. The team can pack

extra “video cameras” to prepare for the eventuality that an event needs extra viewing angles. The absence of cables also reduces the possibility of risks involving people tripping, tangled wires, or unattached cables.

Similar to the conventional MCP, MultPLS can add livestreaming features such as live chats, scrolling credits/title, and picture-in-picture format. The use of OBS in MultPLS makes this process more straightforward as all the sources (e.g., images, text, audio-video input) are grouped in one location. For instance, for a talk show that we livestreamed to Facebook in 2022, questions to the speakers were not only read out loud but shown on screen for the audience to see (Figure 5).

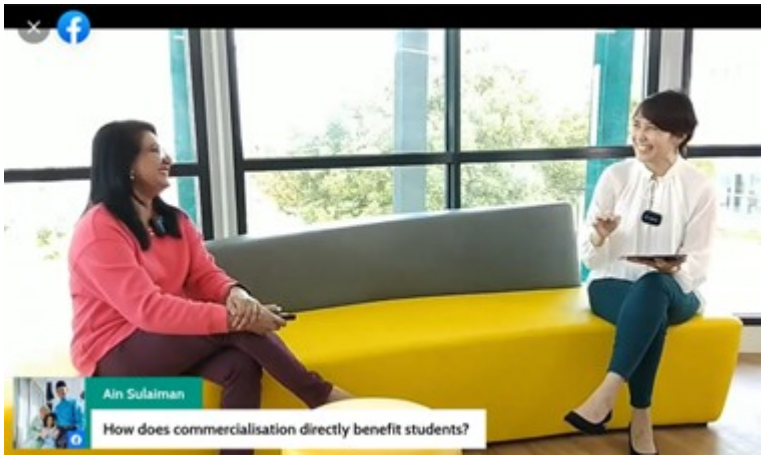


Figure 5: Add-on livestreaming feature that can be done using MultPLS

MultPLS in multiple locations

The weight and size of mobile phones also play an important part in multiple location or remote location streaming, as it is more practical to transport several mobile phones than several video production cameras, especially with limited luggage space. In addition, using mobile phones means that events in satellite locations can be livestreamed without additional technical equipment. This is feasible because mobile phones are telecommunication devices that do not require extra features to be connected to the internet.

In the period of time when MultPLS was utilised, only one event with a satellite location was organised. Figure 6 shows Location 1 on the left, shot here with a roaming mobile phone, and Location 2 on the right, shot with a mobile phone on a stand.

Still from a mobile phone (iPhone 12 Pro Max, 720p @30fps)

Still from a mobile phone (Vivo Y17, 720p @30fps)

Figure 6: Location 1 (main gate of the University) and Location 2 (University hall)

To check whether a farther satellite location can be livestreamed, we performed a livestream test from Betong, a district in Sri Aman, which is about 280 km away from Kuching, the capital of Sarawak. The result showed that this is viable, as long as the satellite venue has adequate internet connection, that is, a minimum of 10Mbps for upload speed. No additional equipment was used for this livestream test.

Figure 7. A snapshot of the livestream from Betong

Financially viable solution

As there is no need to purchase new video production cameras, the costs of acquiring MCP-like results are drastically reduced. Given is the calculation for financial impact for an event that requires two different camera angles (one wireless for roaming and one static), with the assumption that the organiser has to make new purchases:

Setup	Item	Quantity	Estimated cost per item (USD)	Total (USD)
Conventional MCP	Video production camera	2	2,785	**6,080**
	Wireless HDMI	1	480	
MultPLS	Mobile phone	2	112	**224**

Table 2: Cost comparison between MCP and MultPLS for an event

We can calculate the financial savings that can be achieved from Table 1, which is approximately 96%. Costs can also be reduced should there be a need to livestream from a location that needs OBV as mobile phones are telecommunication devices, as opposed to video production cameras that would require network cabling.

Discussion

Whilst event livestreaming typically uses conventional MCP, there are limitations related to the usage of video production cameras in the MCP setup. Our team proposed a solution – augmenting video production camera with mobile (smart) phones – and experimented with the setup for roughly two years. The results have been highly promising in terms of operational and financial sustainability.

The following are the main advantages of MultPLS when compared to the conventional MCP:

1. The video quality from mobile phones is similar to video production cameras' video quality. Video quality is one of the important elements to retain audience interest (Fraser et al., 2019). As mobile phones continue to adopt cutting edge technology, their video capabilities would rise steadily, making them even more viable for video shooting purposes.
2. Mobile phones allow flexibility of movements due to their size and weight. It is easier to operate and more feasible to be carried around and set up, especially if an event has multiple locations. Consequently, this allows for more variety of angles when needed.
3. Considering the current need for digital content, this approach can be utilised for livestreams from locations with no wi-fi as the team can connect the bespoke AP to any available internet line. In addition, the AP secures the connection between the video feeds and the host computer, addressing security issues that may arise.
4. Very minimal costs are needed for MultPLS to operate as there are no need to purchase production video cameras or other equipment needed in the conventional MCP setup. The possibility of getting used mobile phones that are still in excellent condition for video shooting and streaming is very high. For this study, we have been using existing mobile phones, which meant that we did not spend on purchase of new mobile phones.

We posit that the use of mobile phones to support video production cameras is therefore a sustainable method for livestreaming university events. Experts in the field of MCP agreed that when it comes to audience engagement, it is not the quality of the camera per se, but the number of camera angles, which is far more important for an effective livestream (FilmmakerIQ, 2021). Expensive cameras also do not necessarily translate into a bigger audience. In many cases, using many smaller, cheaper video cameras will go a lot further in raising the production quality rather than using one or two high-end cameras as the various angles would be more effective in showing how the event unfolds. This is exactly what MultPLS offers.

Conclusion

Our project contributes to the blooming literature on livestreaming in the educational context and offers a practical and sustainable solution for quality livestreaming. We highlight the potential of our innovation, MultPLS, as a livestreaming technique that is achieved by innovating existing technology and does not require expensive equipment in turning every livestream into a story. MultPLS can especially benefit organisations and communities that would like to livestream their events or programmes but neither possess expensive video camera equipment nor the expertise of handling conventional MCP configurations. We foresee the potential of MultPLS to be utilised in other contexts, such as concerts and sports events.

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