Finishlynx Photo-finish Timing Software

برنامج التوقيت فوتوفينيش

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Abstract:

FinishLynx photo-finish timing software differs from other types of results technology because it powers a full range of EtherLynx line-scan cameras to produce true fully automatic timing (F.A.T.) results accurate to 1/1000th of a second or more. Now that F.A.T. is required by a growing number of national and international athletic organizations (IAAF, USATF, etc.), we've had more and more clubs and federations from across the globe adopting FinishLynx fully automatic timing technology for their race needs.

FinishLynx Photo-Finish Timing Software Allows Users To:

- *Secure file system with enhanced file sharing permissions;*
- *Control multiple cameras simultaneously, mixing monochrome and color;*
- *Native virtual memory for continuous imaging (unlimited maximum capture time);*
- *User-configurable pari-mutuel specific interface with automatic beaten lengths calculation;*
- *Real-time serial user-specified scoreboard interface for running time and results;*
- *Manual or automatic lane identification inside FinishLynx.*

Key words: *Competition Elite Photo-finish System; Championship Photo-finish System; Championship Photo-finish System.*

ملخص الدراسة :

يختلف برنامج توقيت إنهاء الصور FinishLynx عن الأنواع الأخرى من تقنيات النتائج لأنه يدعم مجموعة كاملة من كاميرات مسح خط EtherLynx لإنتاج نتائج توقيت أوتوماتيكي كامل (F.A.T.) بدقة تصل إلى 1000/1 من الثانية أو أكثر. الآن بعد أن أصبح F.A.T. مطلوب من قبل عدد متزايد من المنظمات الرياضية الوطنية والدولية (IAAF، USATF ، وما إلى ذلك) ، لدينا المزيد والمزيد من الأندية والاتحادات من جميع أنحاء العالم التي تتبنى تقنية التوقيت التلقائي بالكامل FinishLynx لتلبية احتياجات السباق الخاصة بهم.

يسمح برنامج التوقيت FinishLynx Photo-Finish للمستخدمين بما يلي:

- نظام ملفات آمن مع أذونات مشاركة الملفات المحسنة؛
- التحكم في عدة كاميرات في وقت واحد ، والجمع بين اللون الأحادي واللون؛
- ذاكرة افتراضية أصلية للتصوير المستمر (أقصى وقت للالتقاط غير محدود)؛
- واجهة خاصة قابلة للتكوين من قبل المستخدم مع حساب أطوال الضرب التلقائي؛
- واجهة لوحة النتائج التسلسلية المحددة من قبل المستخدم في الوقت الحقيقي لتشغيل الوقت والنتائج؛
- تحديد المسار اليدوي أو التلقائي داخل FinishLynx.

الكلمات الدالة: نظام إنهاء صور المنافسة؛ نظام إنهاء الفديو؛ نظام صور النهاية للصور والفديو.

1. INTRODUCTION

FinishLynx is the world's most popular and powerful digital photo-finish and sports timing software. When combined with an EtherLynx photo-finish camera, FinishLynx produces time-stamped results images (accurate to .001 or greater) for world-class fully automatic timing. The FinishLynx software also allows users to interface with an endless combination of cameras, scoreboards, and other 3rd-party accessories to create a powerful and secure results network from behind a laptop.

2. EtherLynx Vision Photo-Finish Camera

The EtherLynx Vision photo-finish camera is a powerful sports timing photo-finish camera with an array sensor that integrates with FinishLynx to produce high-speed results. The Vision has a number of innovative new features to provide next-generation fully automatic timing. It offers full-color photo-finish images by default as well as EasyAlign 2-D Video Alignment Mode, Power-over-Ethernet, Gigabit transfer speeds, LuxBoost low-light amplification, an internal battery option, and much more. The Vision was first released in the US in October of 2014 and will soon overtake the EtherLynx 2000+ as the most commonly used photo-finish camera used in the field today. The camera's advanced features make it well suited for track & field, athletics, cross country, and other running meets.

The Vision photo-finish camera includes new hardware and software features that will make FinishLynx technology more accessible to novice users and even more versatile during track meets. The default camera features will vary by the package configurations and optional upgrades, but see below for a list of some key features available with the 5L500 Vision.

2.1 EasyAlign Video Alignment.

New EasyAlign Full Frame Video Alignment Mode makes it easier than ever to align your camera on the finish line.

2.2 Power-Over-Ethernet.

The camera comes standard with a Power-Over-Ethernet (PoE) injector so no AC power is required at the camera location.

2.3 Full-Color Images.

The EtherLynx Vision camera captures full-color photo-finish images by default. That means all US high school track packages come standard with a color timing camera.

2.4 Gigabit Transfers.

The Vision offers improved data connectivity and is the first EtherLynx camera to allow for full Gigabit Ethernet transfers (1,000 Mbps).

2.5 Silent Operation.

Because of the dramatically reduced power consumption of the Vision camera, there is no need for internal fans or cooling, making it our quietest camera yet.

2.6 Array Sensor.

The Vision is the first Lynx camera to contain an array image sensor. It's what allows users to switch between 1-D and 2-D modes from within the software.

2.7 Backwards Compatible.

The EtherLynx Vision is compatible with all Lynx cameras made since 1996. Add the Vision to your existing results network and be worry-free.

2.8 High-Resolution [Option].

A standard Timing-Enabled, Vision Camera captures 1,000 fps at 640 pixels. Add the High-Resolution upgrade to increase the capture speed to 2,000 fps at 1,280 vertical pixels.

2.9 On-board Level [Option].

The Vision's new on-board level feature allows you to monitor that the camera is level directly from within the FinishLynx software.

2.10 LuxBoost [Option].

LuxBoost greatly amplifies the brightness during low-light captures. Evening events that were once too dark to capture can now be recorded with ease.

2.11 Electronic Filter Control [Option].

The Vision allows you to enable and disable low-light camera filters right from within the FinishLynx software with a click of the mouse.

2.12 Wi-Fi (Wireless) [Option].

Connect a small, external Wi-Fi unit to wirelessly transfer timing & results data.

2.13 Internal Battery [Option].

The 5L500 has an optional internal battery pack. The internal battery allows the camera to continue running in the event of a power outage.

2.14 Phased Light Compensation (PLC) [Upgrade]:

Helps correct the strobing effect of artificial phased lighting when capturing finish line images indoors.

Fig.1. *EtherLynx Vision Photo-Finish Camera*

Source: *IAAF COMPETITION RULES 2004–2005. Available online: http://www.hammerthrow.co.uk/provisional_competition_rules.pdf (accessed on 19 December 2021)*

3. Plugin: Auto Capture Mode

The Automatic Capture Mode (ACM) Plug-in for FinishLynx enables the software to detect and record all finish line activity automatically so you no longer need to press and hold a capture button to record photo finish images. The ACM plug-in also allows your camera to be used as a "virtual photo-eye" that will instantly broadcast running-times, splits, and finish times to any compatible displays at your venue.

3.1 Automatic Capture

The Automatic Capture plug-in turns your EtherLynx camera into a powerful, motion-activated capture device that automatically detects any motion near the finish line and records the images to your computer via the FinishLynx software. With ACM, any activity at the finish line will trigger the camera into action.

Still afraid you might miss something? Don't worry. EtherLynx cameras are equipped with on-board memory, so the FinishLynx software will also record images from a few seconds before and after any activity is detected to provide a buffer zone around each capture. This buffer time is even customizable via the FinishLynx interface. Adding the ACM plug-in allows you to put down the capture button and breathe easy, knowing that you'll never miss a capture again.

3.2 Virtual Photo-Eye:

The powerful motion-detection features unlocked by the ACM plug-in also allows the EtherLynx camera to function like a virtual photo-eye. Because FinishLynx integrates all aspects of the results network (start, timing, displays, etc.), the motion detection capabilities added by ACM can turn your camera into a virtual photo-eye that, when triggered, will automatically broadcast running times or finish times across the network.

This one software plug-in adds a powerful automation features to your FinishLynx system. Put down your manual capture button and add ACM to automatically detect, capture, and display fully

automatic timing results at your venue. It's no surprise that many customers cite ACM as their favorite FinishLynx plug-in.

3.3 Plugin: RadioLynx Wireless

The RadioLynx wireless start plug-in integrates RadioLynx Wireless Start technology with the FinishLynx timing and results software. The RadioLynx plug-in allows users to connect any number of wireless start sensors to their FinishLynx software, providing increased range and mobility for starters during events.

The RadioLynx Wireless Start System replaces the 500' start cable and allows operators to move more freely about the track. The system transmits the start signal with a wireless transmitter and receiver and integrates seamlessly with FinishLynx thanks to the RadioLynx software plug-in.

With RadioLynx, starters can transmit wireless start signals from across the venue directly to the FinishLynx software. The standard RadioLynx transmitter has a range of up to 2 kilometers and transmits a safe, secure, and accurate start signal, precise to within ±0.4 thousandths of a second.

Each transmitter is capable of marking signals with a unique identifier so multiple transmitters can be connected to a single receiver. With the RadioLynx software plug-in, the FinishLynx software can be configured to interface with multiple transmitters that have different functions and locations. It also allows you to preset "active times" for each unit so split times can be gathered from multiple locations, or from a single location at different times. See below for more information on RadioLynx.

4. RadioLynx Wireless Start

The RadioLynx Wireless Start System replaces the 500' start cable and allows operators to move more freely about the track. The system transmits the start signal using a wireless transmitter and receiver and integrates seamlessly with FinishLynx. It is extremely accurate—with precision greater than ±0.4 thousandths of a second.

And thanks to built-in redundancy transmission, the wireless signal is reliable even in the event of a severe disturbance.

The RadioLynx wireless start system consists of a wireless transmitter and a receiver. Each unit is about the size of a deck of cards, which makes them easily portable and accessible during events. And the wireless transmission means you no longer need to worry about "spiked" or tangled start cables inside your venue.

RadioLynx has a wireless range of approximately 2 kilometers and will transmit secure, time-stamped start signals accurate to ± 0.4 thousandths of a second. Because every signal is time-stamped, RadioLynx ensures flawless start signals even if a transmission encounters outside interference. In the event of interference, RadioLynx allows wireless start signals to be sent multiple times; signals can even be re-sent minutes—or even hours—later to ensure critical start data is never lost.

- Provides operator with mobility throughout the venue;
- Interfaces with FinishLynx software for transmission of start signals and photoeye breaks;
- Transmits up to 14 identified intermediate impulses or an unlimited number of unidentified intermediate times;
- Check battery status right from the display;
- Set different frequencies and transmission channels;
- Accurate to ± 0.4 thousandths of a second;
- Built in redundancy transmission code with error correction;
- "Lost" signals can be re-transmitted many times. even after long time lapses;
- All times are stored in on-board memory and can be transferred to a RACETIME2 or REI2 chronometer.

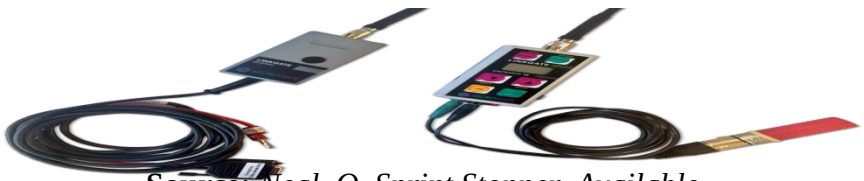
5. FinishLynx Software Integration

Each transmitter is capable of marking its own transmissions with a unique identifier, so that several transmitters can be connected to a

single receiver. When RadioLynx is used with the RadioLynx plugin for FinishLynx, each transmitter can provide data separately.

The FinishLynx software can be configured to use each separate transmitter for different functions (starts or beam breaks), and you can preset "active times" for each unit. This means that split times can be gathered from multiple locations, or from a single location at different times.

Fig.2. RadioLynx Wireless Start



Source: *Neal, Q. Sprint Stopper. Available online: http://sprintstopper.com/ (accessed on 2 November 2021).*

Fig.3. accessories-start/radiolynx-wireless-start

Source: *Neal, Q. Sprint Stopper. Available online: http://sprintstopper.com/ (accessed on 2 November 2021).*

6. Electronic Start System

The Lynx electronic start system interfaces directly with FinishLynx to provide complete synchronization of the start signal, visible flash, and audible tone. It can produce either a start tone or simulated gun sound and is compatible with both wired start and RadioLynx wireless start. The system not only provides superior accuracy, but also removes the need for traditional starting guns and all the smoke, cartridges, and room for human error that come along with them.

This electronic simulated gun creates no noxious fumes, requires no expensive blank cartridges, and, in an age when transporting firearms is highly problematic, requires no gun to start a race. The system ensures absolute accuracy and has a direct interface to all FinishLynx and ReacTime systems. It interfaces directly with an integrated Public Address system to provide audio for athletes.

The hardware is simple to setup: just connect the electronic start signal directly to your FinishLynx system, and then connect the audio output connection to the speaker provided or other permanent PA system in the venue.

- Eliminates the need for a starting pistol;
- No expensive blank cartridges;
- High visibility strobe light;
- Absolute accuracy;
- Direct interface to FinishLynx;
- Choose either simulated gun or tone signal;
- Compatible with a range of audio systems;
- Can be used with RadioLynx for wireless starts;
- Battery-powered for portability.

Fig.4. Electronic Start System

Source: *World Athletics World Athletics Technical Rules. Available online: https://www.worldathletics.org/download/download?filename=1db01fe4-2229-4591-81ec-745bcc6042c7.pdf&urlslug=C2.1%20Technical%20Rules%20(incorporating%20Shoe%20amendments%20approved%20on%2022.12.2021%20effective%20from% (accessed on 18 December 2021).*

7. ReacTime Training Software

The ReacTime Personal Training software allows users to view, graph, analyze, and print reaction data recorded with the ReacTime Training system. The software gives athletes and coaches access to precision reaction data, allowing them to measure and improve performance off the blocks. With the software installed on a computer or netbook, users can download all reaction data from the block sensors and graph reaction times, power output waveforms, and time-to-distance ratios for each start.

Research has shown that reaction times play a crucial role in the success of sprinters. The shorter the race, the more important an

athlete's reaction time becomes, because it "accounts for a greater proportion of the total time of the run." Studies also show that reaction time is a skill that can be improved with training.

The ReacTime Training software allows athletes and coaches to view reaction times across countless different workouts. This allows them to not only isolate on start mechanics, but also graph, track, and share athlete improvements over time.

Consider this excerpt from John D. Barrow, Professor of Mathematical Sciences at Cambridge University:

- "If [Usain] Bolt could get his reaction time down to 0.13 s, which is very good but not exceptional, then he would reduce his 9.58 s record run to 9.56 s. If he could get it consistently down to an excellent 0.12 s then he is looking at 9.55 s, and if he responded as quickly as the rules allow, with 0.10s, then 9.53 s is the result" (2012);
- Reaction training should be a staple part of every athlete's training routine. In fact, many elite-level athletes have relied on it for years. When used with the ReacTime Training System, the Personal Training Software will allow you to measure and graph reaction data and offer a more complete understanding of athlete performance and progress.

Fig.5. ReacTime Training Software

Source: *FinishLynx Fully Automatic Timing and Certified Photo-Finish Results. Available online: https://www.finishlynx.com/finishlynx-fully-automatic-timing-systems/ (accessed on 11 January 2022).*

8. ResulTV: Live Results Display Software

ResulTV is a digital display and graphic generation program that produces live results from FinishLynx timing systems. The Windows-based software allows FinishLynx operators to produce scalable result graphics for output on any compatible graphic display or scoreboard. The ResulTV software can even produce high-quality dynamic images suitable for live broadcast television or internet video streams.

ResulTV can display any FinishLynx data (including athlete names, times, ID numbers, lane assignments, and affiliation). The software is also compatible with FieldLynx, ReacTime, and many 3rd-party meet management programs, which allows users to output start lists, athlete splits, running times, and live results.

ResulTV is designed to be an operator-free program that displays results data dynamically by using pre-configured layouts. But at more complex events, it's also possible to have several ResulTV layouts active simultaneously so operators can toggle between layouts with a simple click.

This ability for customization means that operators can produce sophisticated, event-branded graphics for even the most complex sporting events. That's why ResulTV has been trusted at the highest levels of competition, including the USATF National Championships and US Olympic Trials.

- User-configurable graphics and layouts;
- Supports both static and dynamic text fields;
- Supports both static and dynamic 24-bit graphics;
- Supports live results and running times;
- Supports multiple data sources (FinishLynx, LynxPad, ReacTime, etc.);
- Supports most 3rd-party meet management programs;
- Supports PAL and NTSC formats;
- Supports full range of Windows fonts;

- Supports foreign language characters (Chinese, Korean, Russian etc.);
- Supports transparent images and overlays.

Fig.6. ResulTV: Live Results Display Software

Source: *Neal, Q. Sprint Stopper. Available online: http://sprintstopper.com/ (accessed on 2 November 2021). Voigt, A. Photo Finish. Available online: https://photofinish-app.com/ (accessed on 2 November 2021).*

9. CONCLUSION

A line-scan photo-finish image is comprised of a series of incredibly thin vertical image slices from the finish line (and any object that is crossing it). EtherLynx line-scan cameras capture these vertical images a thousand times per second or more. Each image slice is timestamped, then combined to create a long, highly precise photo-finish image. As more and more 1-pixel-wide vertical slices are captured and combined, the complete timestamped FinishLynx capture begins to take shape.

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