Track Analyzer

Accessible Biomechanical Analysis System for Track & Field

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Contents

Abstract

Executive Summary: This document outlines the proposal for *Track Analyzer*, a mobile application designed to make high-level motion analysis for athletics accessible. By leveraging state-of-the-art AI models (Pose Estimation), the system provides immediate, accurate feedback on technical gestures without expensive hardware. This report details the market opportunity, the validation process with elite coaches, and the technical architecture required for implementation.

1 Project Vision & Problem Statement

1.1 Domain

The application operates within the context of *athletics*, with particular focus on rapid and technical movements, such as sprint training, horizontal jumps, vertical jumps and throws. The target domain requires tools capable of providing accurate motion analysis while maintaining low costs and immediate usability.

1.2 Problem Identification

There are many professional tools for cinematic analysis, but they either need a computer for post-processing or rely on very expensive hardware. There's still no **accurate**, **affordable** and **real-time** solution that works using just a **smartphone**.

1.3 Stakeholder Validation

To validate the market need, interviews were carried out with industry **experts**, including elite track & field coach **Marco Airale**, who works with several Olympians. He showed strong interest in the product and even expressed willingness to support its development financially, as a solution like ours could *"make his job easier"*. The discussion highlighted three core needs:

- **Simplicity:** "Keep it simple" – upload, process, analyze.
- **Immediacy:** Analysis must happen on the field via smartphone.
- **Relevance:** Only biomechanically significant angles matter.

We also conducted an interview with **Marco Orsellini**, track & field coach and kinesiologist, who routinely works with high–level biomechanical tools. His feedback emphasized a critical gap: the **lack of real–time analysis on the field**. Today, video review typically happens hours later on a computer, forcing coaches to postpone technical corrections to the following training session. Orsellini noted that if a system could deliver meaningful biomechanical metrics within a few minutes, he could adjust an athlete's technique immediately, drastically increasing the likelihood of performance improvement.

Finally, we gathered feedback from **athletes**, whose perspective is equally relevant. **Daria Rigatti**, Swiss U20 vice–champion in the Long Jump, expressed a strong interest in a tool that allows her coach to monitor run–up steps and take–off angles in real time. According to her, having instant access to these indicators would make technical refinement faster and more consistent. Her comments also emphasize the broad applicability of the solution: the same principles can support athletes across a wide range of disciplines, not only in athletics but in many sports where movement efficiency matters.

2 User Analysis & Requirements

2.1 User Personas

- **The World-Class Coach:** Values precision, is used to complex tools, and wants something portable on the field.
- **The Everyday Coach:** Needs simplicity, quick setup, and rapid feedback during sessions.
- **The Competitive Athlete:** Typically has solid knowledge of correct angles and biomechanics, and wants to analyze themselves when the coach is not available at that moment.
- **The Self-Trained Athlete:** Wants to analyze themself to improve technique and make comparisons over time.

2.2 Functional Requirements

The system **must**:

- Allow the user to upload videos and photos to be processed by the analysis module.
- Compute joint positions, lines, and angles through a pose–estimation pipeline.
- Display the video with biomechanical overlays.
- Provide frame-by-frame navigation through a timeline slider with deterministic frame indexing.
- Allow the user to select which angles to measure, including custom naming and reference thresholds.
- Show real-time visual indicators of whether each measured angle is within or outside the configured thresholds.
- Allow the user to export the processed video with all biomechanical annotations.
- Prevent the user from uploading videos longer than 10 seconds.

As a **non-functional requirement**, the system should return the fully processed and annotated video within one minute from the moment the user uploads it.

3 Market Analysis & Business Model

3.1 Market Size Estimation (SAM & SOM)

Our **Serviceable Addressable Market** (SAM) is calculated using a bottom-up approach, anchored by certified data from the Italian Athletics Federation (FIDAL). The initial core segment comprises technical directors and specialized coaches:

$$683 \text{ (Specialists Coaches)} + 6,767 \text{ (Coaches)} + 1,545 \text{ (Instructors)} = 8,995$$

To justify the global estimate of $N = 100{,}000$ potential users, we apply a standard **Athlete-to-Coach Ratio** (ρ). According to FIDAL data, the number of registered athletes in Italy is approximately 170,000, but this figure also includes non-competitive categories such as amateurs and children.

To obtain a clearer picture, according to the World Athletics Ranking tables, the number of *ranked* Italian athletes is approximately 2,000, which represents only a small fraction of all competitive athletes.

Standing on these numbers, we believe that in track & field contexts a conservative ratio is therefore $\rho \approx 10{:}1$. By including athletes as active data contributors, the potential user base expands significantly:

$$\text{Total Addressable Ecosystem} \approx 8,995 \times (1 + \rho_{10}) \approx 98,945 \rightarrow \approx 100k \text{ Users}$$

This validates the global pilot scale by including the necessary volume of athletes required to feed the analytics engine for the professional segment.

3.2 Strategic Segmentation & Revenue Model

Instead of a generic conversion funnel, we adopt a stratified value model adhering to the **Pareto Principle**. The user base is divided into two distinct functional segments:

- **The Value Drivers (80%):** Comprising instructors and athletes. While this segment is monetized at Average Revenue Per User $ARPU \approx 0$, their retention is critical. They generate the data volume, drive ecosystem reviews, attract advertisers, and refine the algorithm, making the app essential for the paying tier.
- **The Revenue Core (20%):** Comprising professional coaches and trainers. This segment generates roughly 80% of the product's value.

3.3 Advertising Strategy (Monetizing the Free Tier)

Data analysis suggests that even with a strong Pro value proposition, roughly 80% of users will remain on the free tier. Relying solely on subscriptions leaves this large segment unmonetized. To address this, we introduce a *"Waiting Room"* **Advertising Model**:

- **Placement:** Ads are shown *exclusively* during the video processing time.
- **Content:** High-quality, non-intrusive ads targeted at runners (e.g., running shoes, spikes, technical apparel).
- **User Experience:** This transforms "dead time" into a discovery opportunity. The ads are non-disruptive to the workflow, potentially interesting to the specific target audience, and ensure revenue generation without compromising the user experience.

3.3.1 Revenue Potential (High-Value Vertical Niche)

Unlike generic display advertising, this hyper-vertical focus allows us to command premium rates. Active athletes viewing technical gear represent a "high-intent" demographic, justifying a **CPM** (Cost Per Mille) significantly higher than market averages.

Assuming a conservative CPM of $25 and an average of 5 uploads per user/month among the 80,000 free users, this stream can be monetized for substantial supplementary revenue:

$$\text{Ad Revenue} = \frac{80,000 \text{ users} \times 5 \text{ uploads}}{1,000} \times \$25 \approx \$10,000/\text{mo} \rightarrow \$\mathbf{120,000}/\text{year}$$

For the initial launch, **Italy** will serve as the **pilot market**. By focusing our resources here, we can leverage full localization (not just in language, but in cultural relevance) to create a premium environment for advertisers.

Crucially, this localized approach allows us to bypass standard programmatic ad networks and, instead, negotiate **direct contracts** with **local distributors** and companies.

- **Direct Relationships:** We can sell premium inventory directly to Italian brands looking for targeted, local engagement.
- **Higher Yield:** By removing intermediaries and offering high-quality, localized placement, we can command a significantly higher CPM (Cost Per Mille) compared to global averages.

The following calculations demonstrate the revenue projection within the Italian pilot market, assuming a premium direct-sales CPM of $50 and a user base of 10,000. Assuming an average active user generates **5 analysis / month**:

$$\text{Total Monthly Impressions: } 8,000 \text{ users} \times 5 \text{ impressions} = 40,000 \text{ impressions}$$

$$\text{Ad Revenue (Italy)} = \frac{8,000 \text{ users} \times 5 \text{ uploads}}{1,000} \times \$50 \approx \$2,000/\text{mo} \rightarrow \$\mathbf{24,000}/\text{year}$$

With a 10k user base in Italy, securing a premium $50 CPM via local resellers can generate around **$2,000** in **monthly recurring revenue**, with conservative user engagement.

3.4 Pricing (Monetizing the Pro Tier)

3.4.1 Tier Structure & Premium Positioning

To maximize **Annual Recurring Revenue** (ARR) and secure upfront cash flow, we utilize a tiered pricing strategy that heavily incentivizes long-term commitment. The pricing model is segmented as follows:

- **Monthly Plan:** $29.99/mo (entry level flexibility)
- **6-month Plan:** $124.99/6mo (aligned with athletic seasons)
- **Annual Plan:** $199.99/yr (best offer, equivalent to ≈ $16.60/mo)

We also offer a Basic plan for $12.99/mo, designed for those who make sporadic use of the motion-analysis tool but don't require the full coaching support features.

Psychological Price Signaling (The "No-Toy" Policy)

A critical component of our strategy is **Price-Quality Signaling**. In the specialized sports analytics market, low-cost applications (e.g., $4.99 - $9.99) are perceived by professional coaches as consumer-grade "toys" or fitness trackers lacking technical accuracy.

By positioning the entry point at $29.99/mo and the core license at $199.99/yr, we signal that the platform is a **professional-grade SaaS tool** designed for high-performance management, distinguishing it from mass-market amateur apps.

Conversion Logic

The pricing structure offers a ≈ 45% discount on the annual plan compared to the monthly rate. This aggressive discounting drives users toward the $199.99 price point, ensuring greater user loyalty, higher retention rates, and more predictable revenue.

3.4.2 Acquisition Mechanics: The Hybrid Freemium Model

To minimize Customer Acquisition Cost and bridge the gap between the free ecosystem and the premium tier, we adopt a hybrid *Freemium* strategy designed for risk reversal.

1. **Permanent Free Access (The Data Feeders)**

   As outlined in the segmentation, the "Value Drivers" (Instructors and a segment of Athletes) will likely operate on a permanent free license. This ensures no friction in data generation, guaranteeing that the platform remains populated with the performance metrics required by the paying coaches.

2. **2. 30-Day Full-Feature Trial (The Professional Hook)**

   For the "Revenue Core" (Head Coaches), we mitigate the barrier to entry of the $199.99 price point by offering a generous **30-day free trial** with full access to premium analytics.

Strategic Rationale: The "Mesocycle" Logic

The choice of a 30-day window is not arbitrary; it is specifically calibrated for the track and field domain. We follow the philosophy of *"taking the app away only once users can't imagine training without it."*

- **Data Accumulation:** Unlike consumer apps, professional analytics require time to build a trend line. A standard 7-day trial is insufficient to visualize training load adaptation: sprint training is usually not performed every week, so a 7-day discourages users from building up the habit.
- **The Training Block:** Thirty days corresponds to 1-2 standard athletic *Mesocycles* (2-4 weeks). This allows the coach to input one or two full training blocks, execute them, and witness the "Input $\rightarrow$ Analysis $\rightarrow$ Adaptation" loop.

By the end of day 30, the platform has become an integral part of their workflow, significantly increasing the conversion rate to the discounted Annual Plan.

3.4.3 Revenue Projection

We assume a premium price point of $P = \$199.99$/year (the Annual Plan). Contrary to unrealistic mass-market conversion rates (100%), we target a specific penetration within the Core segment.

Based on the strategy that the "20% segment generates the revenue," and assuming a conservative conversion of 10% within that specific high-value subset:

$$\text{Paying Users} = N_{total} \times \underbrace{0.20}_{\text{Core Segment}} \times \underbrace{0.10}_{\text{Conversion Rate}} = 0.02 \times N_{total}$$

Financial Projections (Scenario Analysis)

Pilot Phase (Italy Only): With an ecosystem of $\approx 11,000$ users (Technicians + Pilot Athletes), revenue aligns with the initial strategic target:

$$R_{pilot} \approx 11,000 \times 0.02 \times \$199.99 \approx \mathbf{\$44,000/year}$$

Global Expansion (Scale Phase): Upon reaching the projected $100,000$ global users (validated by the athlete ratio), the model scales effectively:

$$R_{global} \approx 100,000 \times 0.02 \times \$199.99 \approx \mathbf{\$400,000/year}$$

4 Marketing Strategy & Budget

Our Go-To-Market strategy utilizes a low-capital approach, heavily relying on the tight-knit nature of the athletic community. However, the execution strategy adapts significantly between the **Pilot Phase (Italy)** and the **Scale Phase (Global)**.

The following breakdown details the strategies and their associated costs for both 10,000 and 100,000 user scenarios.

4.1 Strategy 1: Influencer Partnerships (Barter vs. Hero)

Concept: We leverage the credibility of technical coaches and athletes.

- **Italy** (10k Users): We utilize a strict **Barter Model**, partnering with 50 local micro-influencers (national level athletes/coaches) providing a Free Pro License ($199 value) in exchange for monthly content (*Cash Cost: $0*).
- **Global** (100k Users): The barter model continues for micro-influencers, but we introduce a **"Hero" Budget**. To break into the US or UK markets, we allocate funds to sponsor 2-3 high-profile Olympian coaches to act as brand ambassadors.

4.2 Strategy 2: Content Engineering (Viral & Paid)

Concept: Creating "Oddly Satisfying" biomechanical overlays for TikTok/Reels.

- **Italy** (10k Users): Content is produced in-house by the team using existing hardware. The only cost is software licensing (Adobe Suite) and minor "boost" budget for Instagram ads targeting the Rome/Milan areas.
- **Global** (100k Users): We scale production by hiring freelance video editors specialized in sports motion graphics. Additionally, the ad spend increases to retarget users who engage with the viral content.

4.3 Strategy 3: Activation (Field vs. Affiliate)

Concept: Getting the product into the hands of decision-makers.

- **Italy** (10k Users) – **"Boots on the Ground"**

  The most effective strategy in Italy is physical presence. We allocate budget for travel and booth setup at major FIDAL events (e.g., Italian Championships). Meeting 20 Head Coaches in person yields higher conversion than 10,000 impressions.

- **Global** (100k Users) – **"Digital Affiliate Network"**

  Physical travel is unsustainable globally. We shift to an **Affiliate Model**, offering verified coaches a 20% commission on every Pro subscription they refer. This variable cost scales perfectly with revenue.

Collaborating with existing athletics platforms, such as *Atletica.me*, could become another valuable user-acquisition channel.

4.4 Marketing Cost Estimation

The following table estimates the monthly marketing expenditure required to sustain the user bases defined in the Financial Projections.

Marketing Channel	**Cost Driver**	**Italy (10k) (Monthly)**	**Global (100k) (Monthly)**
Influencer Program		**$0**	**$2,500**
Micro-Influencers	License Barter	$0	$0
Hero Ambassadors	Stipend/Sponsorship	N/A	$2,500
Content & Ads		**$600**	**$5,500**
Production	Software / Freelance	$100	$1,500
Paid Social (Boost)	Meta/TikTok Ads	$500	$4,000
Field & Activation		**$1,200**	**$2,000**
Events (Travel/Booth)	Physical Presence	$1,200	N/A
Affiliate Network	Software Management	N/A	$500
Partnerships	Digital Collabs	N/A	$1,500
Total Monthly Budget		**$1,800**	**$10,000**

Table 1: Estimated Monthly Marketing Budget for Pilot vs. Scale Phases.

- **National Scenario:** With a monthly marketing spend of **$1,800** and projected revenue of $\approx$ **$3,600/mo** (from subscriptions) + **$2,000/mo** (from ads), the project is cash-flow positive even during the aggressive acquisition phase.
- **Global Scenario:** A **$10,000/mo** budget represents only $\approx 30\%$ of the projected monthly revenue ($\approx$ $33,000), ensuring a healthy margin for R&D and server costs.

5 Technical Architecture & Solution

5.1 Technology Stack

- **Frontend:** Flutter (Cross-platform UI).
- **Backend:** FastAPI, RTMlib, FFmpeg.
- **Core ML:** RT-DETRv4, RTMPose, MotionBERT, opencv, NumPy, PyTorch.
- **Cloud Architecture:** AWS Lambda, AWS S3, AWS DynamoDB, AWS Eventbridge, Modal Serverless GPU Functions.

All libraries are licensed with permissive licenses, and all models are open source and open weights, with Apache 2.0 License: the project is fully commercially compliant.

5.2 Data Pipeline

1. **Video Input** – Acquisition of the raw video stream.
2. **Frame Extraction** – Sampling of frames for processing, using opencv.
3. **Person Detection** – Identification of the human figure (Bounding Box), using RT-DETRv4-M, image size 320x320.
4. **Pose Estimation** – Detection of 2D keypoints, using RTMPose-L, trained on Body8 dataset, image size 192x256.
5. **Pose 3D Lifting** – Transformation of coordinates from 2D to 3D, using MotionBERT with 1 frame window.
6. **Post-processing** – Smoothing is performed using a Savitzky-Golay filter. This allows us to both remove residual jittering and also have the joints as continuous and differentiable functions instead of discrete datapoints, which is useful to calculate velocities.
7. **Angle calculation** – Angles are calculated via trigonometric functions of the 3d joints.
8. **UI Overlay** – Rendering of AR graphics over the original video, using opencv, along with the watermark.
9. **Video Encoding** – Compression and re-encoding of the final output, using FFmpeg.

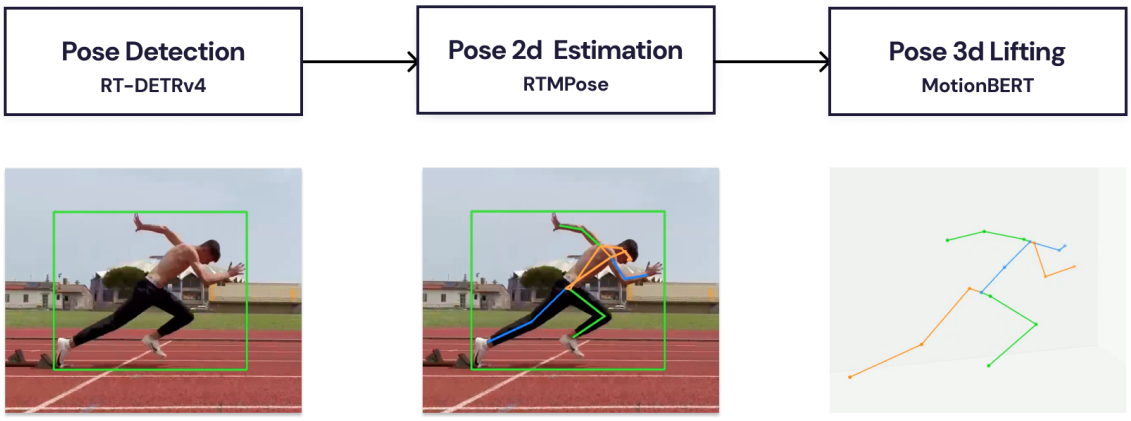

Figure 1: AI models pipeline

5.3 Pipeline Performance

The pipeline is able to process at 15fps on Intel i5 10210u, with UHD620 GPU. Such speeds are achieved by converting models from PyTorch to OpenVINO, with fp16 precision. By processing 30fps videos, at most 10 seconds long, the processing latency is guaranteed to be under 20 seconds. By leveraging in-cloud Nvidia Tesla T4 GPUs the latency can be further reduced to approximately 5 seconds. Further optimizations will consist of latency reduction, via model compression, reducing library weight and, eventually, adding a compilation step.

5.4 Cloud Architecture

The **data flow** consists of these steps (note that it does not yet provide authentication):

1. The client requests a presigned Url to upload the video on S3 by invoking the first Lambda function
2. The client uploads the video on S3
3. Upon uploading, a Cloudwatch Eventbridge event fires, invoking the second Lambda function
4. The second Lambda function invokes a Modal Serverless GPU Function.
5. The Modal Function pulls the video from S3, produces an overlayed video, then uploads it on S3
6. The client is polling S3 to download the video
7. Each video uploaded is deleted upon download from the client or within 1 hour, via S3 lifetime policy.

5.5 Cost Estimation (eu-west-1)

We performed a cost analysis for the `eu-west-1` (Ireland) region, considering two scaling scenarios:

1. **10k active users** (50,000 invocations/month).
2. **100k active users** (500,000 invocations/month).

5.5.1 Assumptions

To calculate storage and bandwidth, we assume the input video is 5 seconds long, 1080p at 60fps. Using a standard H.264 high bitrate (approx. 12 Mbps), the estimated file size is **7.5 MB**.

- **Data Transfer Out (DTO):** In the server-side rendering architecture, the video leaves AWS S3 twice (once to the Modal GPU, once to the client), and total DTO is 15 MB $\times$ Invokes.
- **GPU Compute:** We assume a 10-second inference time on an NVIDIA T4 GPU via Modal.com (priced at approx. \$0.59/hour or \$0.000164/sec).
- **AWS Lambda & S3 Requests:** Based on standard pricing (\$0.20/1M requests), these costs are negligible compared to bandwidth and GPU costs.

5.5.2 Projected Monthly Costs (Architecture 1: Initial Modal Serverless)

The following table details the estimated monthly expenditure for the initial server-side rendering architecture (Full Video DTO).

Resource	**Unit Price (Approx.)**	**10k Users (Monthly)**	**100k Users (Monthly)**
S3 Data Transfer (Out)	\$0.09 / GB	\$67.50	\$675.00
Modal GPU (T4)	\$0.000164 / sec	\$82.00	\$820.00
Lambda & Requests	Varies	$\sim$\$2.00	$\sim$\$10.00
Total Cost		**\$151.50**	**\$1,505.00**

Table 2: Estimated Monthly costs for initial Modal Serverless architecture.

5.5.3 Architectural Optimization (Architecture 2: Client-Side Rendering)

This option uses Client-Side Rendering to eliminate the generated video's download transfer, reducing DTO by 50%.

Resource	**Unit Price (Approx.)**	**10k Users (Monthly)**	**100k Users (Monthly)**
S3 Data Transfer (Out)	\$0.09 / GB (Reduced 50%)	\$33.75	\$337.50
Modal GPU (T4)	\$0.000164 / sec	\$82.00	\$820.00
Lambda & Requests	Varies	∼\$2.00	∼\$10.00
Total Cost		**\$117.75**	**\$1,167.50**

Table 3: Optimized Monthly costs using Client-Side Rendering (Modal Serverless).

5.5.4 Alternative Architecture (Architecture 3: AWS EC2 Fixed GPU)

This option uses a single, persistent AWS EC2 instance. This eliminates the Data Transfer Out cost for transferring the video to the GPU since S3-to-EC2 traffic in the same region is free (assuming a Gateway Endpoint is used). Only the negligible CSV metadata is transferred outwards. The **Hardware Selection** is the following:

- **10k Users:** A `g4dn.xlarge` (NVIDIA T4, \$0.587/hr → \$428.51/mo).
- **100k Users:** A `g5.xlarge` (NVIDIA A10G, \$1.123/hr → \$819.79/mo), providing higher throughput for the large volume.

Resource	**Specs / Pricing**	**10k Users** (`g4dn.xlarge`)	**100k Users** (`g5.xlarge`)
EC2 Compute Cost	Hourly (On-Demand)	\$428.50	\$819.80
S3 Data Transfer	Free (Same Region)	\$0.00	\$0.00
EBS Storage	General Purpose SSD	∼\$10.00	∼\$10.00
Total Monthly Cost		**\$438.50**	**\$829.80**

Table 4: Estimated Monthly costs for EC2-based architecture (Fixed Compute / Client-Side Rendering).

5.6 Revised Cloud Architecture Data Flow

The **optimized data flow** consists of the following steps:

1. The client requests a presigned URL to upload the raw video to S3 by invoking the first Lambda function.
2. The client uploads the video to S3.
3. Upon upload completion, a CloudWatch EventBridge event fires, invoking the second Lambda function (or directly triggering the EC2 worker).
4. The GPU Worker (Modal or EC2) downloads the video from S3, performs inference, and generates a lightweight metadata file (CSV/JSON).
5. The Worker returns the metadata directly to the application.
6. The client renders the graphics over the local original video in real-time.
7. The raw video on S3 is deleted within 1 hour via the S3 lifecycle policy.

Serverless functions allow for greatly reduced costs for sparse workloads and also maximum scalability. When switching to a permanent ec2 instance, although scalability is compromised in bursts of requests, it is possible to keep a queue of requests, giving priority to Pro users (therefore guaranteeing low latency) and applying batching techniques to shorten wait time in queue. The system is also zero-retention by design, so it is also compliant with GDPR.

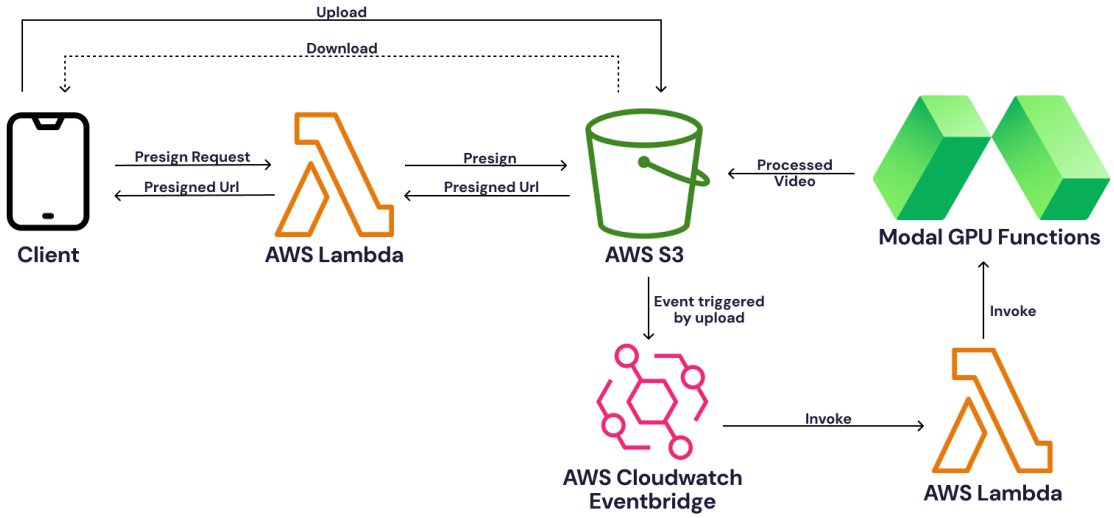

Figure 2: Unoptimized event-based cloud architecture

6 Cost Analysis & Financial Projection

This section consolidates the revenue streams, operational costs, and fiscal obligations to assess the project's financial viability. The analysis includes Italian taxation (VAT/IVA) and specific platform fees (Apple Developer Program), providing a clear view of the net income for both the Pilot (Italy) and Global expansion phases.

6.1 Assumptions & Fiscal Constraints

- **VAT (IVA):** Applied at the standard Italian rate of **22%**. The pricing ($199.99/yr) is treated as the Gross Price paid by the consumer (B2C). Therefore, Net Revenue is calculated as Gross/1.22.
- **App Store Fees:** Calculated at the **15% Small Business Program** rate. This commission is applied to the **Net Subscription Revenue** (Gross Subscriptions excluding VAT). Advertising revenue is assumed to be net of platform fees.
- **Architecture:** Operational costs are based on the *Optimized Client-Side Rendering (Architecture 2)* model presented in Section 5.5.3, as it offers the best balance of cost-efficiency and scalability.
- **Platform Fees:** Apple Developer Program is included as a fixed annual cost.

6.1.1 Annual P&L Statement (Profit & Loss)

The following table contrasts the financial performance of the Pilot Phase (10k Users) against the Global Scale Phase (100k Users).

Category	**Line Item**	**Pilot (Italy)** *(Annualized)*	**Global (Scale)** *(Annualized)*
REVENUE			
	Subscriptions (Gross)	$44,000.00	$400,000.00
	Advertising (Gross)	$24,000.00	$120,000.00
	Total Gross Revenue	**$68,000.00**	**$520,000.00**
TAXATION			
	VAT Liability (22% included)	($12,262.30)	($93,770.49)
	Net Revenue	***$55,737.70***	***$426,229.51***
EXPENSES			
Platform	Store Commission (15% of Subs)	$5,409.84	$49,180.33
Infrastructure	Cloud Costs (Arch. 2)	$1,413.00	$14,010.00
Marketing	Mktg Budget (Annualized)	$21,600.00	$120,000.00
Compliance	Apple Developer Program	$99.00	$99.00
	Total OpEx	**$28,521.84**	**$183,289.33**
RESULT			
	EBITDA (Pre-Corp Tax)	**$27,215.86**	**$242,940.18**

Table 5: Annual Financial Projection comparing Pilot vs. Global phases, inclusive of VAT, Store Fees, and Operational Expenses.

6.2 Profitability and Scalability Analysis

- **Pilot Phase Sustainability**

  Even after accounting for the 22% VAT liability, the 15% App Store commission, and an aggressive marketing push, the Pilot phase remains profitable with a positive EBITDA. This confirms that the $199.99 price point provides sufficient margin to absorb both fiscal pressure and platform fees.

- **Global Scalability**

  In the Global scenario, the business demonstrates strong scalability. While platform fees scale linearly with revenue, the fixed nature of many operational costs allows the EBITDA margin to remain healthy at approximately **46%** of Gross Revenue.

7 Project Roadmap

7.1 Development Roadmap

1. **Phase 1: Specification ✓**

   Conducted expert interviews and market research to establish a clear domain definition. Defined core user problems and defined the initial feature set to ensure product-market fit.

2. **Phase 2: Design ✓**

   Created low-fidelity and mid-fidelity wireframes and high-fidelity UI/UX mockups using Figma to project user experience and map user journeys. Performed technical feasibility studies to select the optimal technology stack and validate the architectural approach for AI integration.

3. **Phase 3: Development** (ongoing)

   Active development of the *Minimum Viable Product* (MVP), focusing on highly requested features. MoSCoW priorities include implementing robust backend logic and a responsive frontend interface to ensure a seamless user experience.

4. **Phase 4: Validation**

   Establishment of low-latency and scalable cloud infrastructure. Focus will shift to rigorous QA testing and AI model optimization, specifically targeting inference speed, latency reduction, and resource efficiency under load.

5. **Phase 5: Evolution**

   Official market launch, app store submission, and execution of the go-to-market strategy. Post-launch, the platform will scale by leveraging transfer learning to adapt core technologies to new verticals and integrating advanced features, such as full coaching support with an integrated stopwatch, athlete profiles, and more. The robustness and performance of our model will eventually allow us to expand into several other sports as well.