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Hirefy: AI-Powered Recruitment Platform

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Final Course Project submitted to the Institute of Technology and Leadership (INTELI), to obtain a bachelor's degree in Computer Science.

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Resumo

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Este trabalho apresenta o desenvolvimento da Hirefy, uma plataforma de recrutamento baseada em agentes autônomos de inteligência artificial, projetada para otimizar processos seletivos e reduzir significativamente o tempo de contratação. O estudo concentra-se na aplicação de tecnologias de processamento de linguagem natural, síntese de voz e modelos de linguagem de grande escala para conduzir entrevistas automatizadas de forma indistinguível de interações humanas. O objetivo principal consiste em desenvolver uma solução escalável que realize triagens iniciais de candidatos de maneira autônoma, eliminando vieses e garantindo avaliações consistentes em múltiplos idiomas, incluindo português, inglês e espanhol. A metodologia adotou desenvolvimento ágil em sprints, contemplando a criação de interfaces responsivas, integração com provedores de autenticação, implementação de pipelines de integração e entrega contínuas, e refinamento de modelos de síntese de voz para o português brasileiro. A parceria com empresa especializada em metodologias de avaliação comportamental permitiu validar a solução em cenários reais de recrutamento. Os resultados demonstram a viabilidade técnica da plataforma, evidenciada pela participação no Web Summit Rio 2025, onde foram captados dez clientes potenciais e estabelecido compromisso de investimento condicionado a metas de aquisição. O sistema foi implantado em ambiente de produção com estratégia de deploy sem interrupção de serviço. Conclui-se que a aplicação de agentes autônomos de inteligência artificial em processos de recrutamento apresenta potencial significativo para transformar práticas tradicionais de seleção, oferecendo escalabilidade, redução de custos operacionais e melhoria na experiência do candidato, enquanto mantém padrões elevados de consistência e imparcialidade nas avaliações.

Palavras-chave: inteligência artificial; recrutamento e seleção automatizado; agentes autônomos; processamento de linguagem natural; síntese de voz.

ABSTRACT

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This work presents the development of **Hirefy**, a recruitment platform based on autonomous artificial intelligence agents, designed to optimize hiring processes and significantly reduce time-to-hire. The study focuses on the application of natural language processing technologies, voice synthesis, and large language models to conduct automated interviews in a manner indistinguishable from human interactions. The main objective is to develop a scalable solution capable of autonomously performing initial candidate screenings, eliminating bias and ensuring consistent evaluations across multiple languages, including Portuguese, English, and Spanish. The methodology adopted agile development in sprints, encompassing the creation of responsive interfaces, integration with authentication providers, implementation of continuous integration and delivery pipelines, and refinement of voice synthesis models for Brazilian Portuguese. A partnership with a company specialized in behavioral assessment methodologies enabled validation of the solution in real recruitment scenarios. The results demonstrate the technical feasibility of the platform, evidenced by its participation in Web Summit Rio 2025, where ten potential clients were engaged and an investment commitment was established, contingent upon acquisition targets. The system was deployed in a production environment using a zero-downtime deployment strategy. It is concluded that the application of autonomous artificial intelligence agents in recruitment processes holds significant potential to transform traditional hiring practices, offering scalability, reduced operational costs, and an improved candidate experience, while maintaining high standards of consistency and impartiality in evaluations.

Keywords: artificial intelligence; automated recruitment and selection; autonomous agents; natural language processing; voice synthesis.

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1 Introduction

Traditional hiring processes are resource-intensive, introducing subjective bias and extended cycles averaging 45-60 days in Brazil, with costs between R\$3,000-8,000 per hire. The Brazilian market context of 2025 features GDP growth of 3.4%, unemployment at 6.2% (UNITED STATES DEPARTMENT OF STATE, 2025), and a deficit of 530,000-797,000 IT professionals (BRASSCOM, 2021). The "Brazil Cost" (Custo Brasil) imposes some of the highest non-wage labor costs globally — mandatory benefits inflate payroll by over 70%.

AI and natural language processing technologies present an opportunity to transform recruitment through autonomous agents capable of preliminary screenings at scale. The HR Tech market in Latin America projects 15.5% CAGR through 2030 (GRAND VIEW RESEARCH, 2024). The key technological trend is the transition from text-based chatbots to real-time voice agents.

This work develops Hirefy, an AI-powered platform that reduces time-to-hire, decreases costs, and ensures consistent, bias-free evaluations across Portuguese, English, and Spanish.

1.1 Context and Motivation

Recruitment teams struggle with resource-intensive initial screening processes that consume 30-40% of hiring cycle time and generate significant operational costs. Small and medium-sized enterprises particularly lack access to sophisticated recruitment technologies due to cost prohibitions, while larger organizations face scalability challenges during high-volume hiring.

The identified market opportunity stems from demonstrated customer pain points: organizations receive 50-200 applicants per open position but lack efficient screening mechanisms, creating bottlenecks that delay hiring and prevent top candidates from advancing.

1.2 Problem Definition and Value Proposition

Hirefy addresses recruitment challenges through autonomous interview agents that deliver value across multiple dimensions. Time value: reduction in time-to-hire through parallel candidate processing. Cost value: cost reduction per hire through elimination of manual screening labor. Quality value: consistent, bias-free evaluation through standardized assessment criteria applied across all candidates. Experience value: 24/7 interview availability with rapid feedback improves candidate experience and strengthens employer brand. Scale value: organizations can process more candidates without proportional increases in recruiting staff.

1.3 Objectives of the Work

General objective: develop and validate a computational solution for autonomous recruitment interviews and create a comprehensive business plan for market introduction and growth.

Specific objectives: a) develop MVP with autonomous interviews in Portuguese, English, and Spanish, b) achieve voice synthesis with <300ms latency for natural interaction, c) validate with 10+ prospective customers, d) establish partnership with behavioral assessment provider, e) define sustainable revenue model with positive unit economics.

1.4 Justification and Contributions

The global recruitment software market reaches \$20.8 billion by 2030. Brazil and Latin America are underserved — only 35% of SMEs have implemented recruitment technology. McKinsey estimates AI-empowered recruitment could unlock \$4.4 trillion in global productivity (MCKINSEY, 2025).

For organizations with significant hiring volumes, Hirefy delivers substantial direct cost savings. The novel integration of large language models, real-time voice synthesis, and autonomous agents advances responsible AI application in high-stakes human decisions through the FATE framework (Fairness, Accountability, Transparency, Ethics).

1.5 Work Structure

Section 2 presents Solution Development. Section 2.1 covers Definition of Market Assumptions and Hypotheses. Section 2.2 addresses Market Sizing and Analysis. Section 2.3 examines Competitive Analysis and Differentials. Section 2.4 describes the Technological Solution. Section 2.5 presents The Business Plan. Section 2.6 documents Validation and Results. Section 3 presents the Conclusion, with Section 3.1 covering Achievement of Objectives, Section 3.2 addressing Future Projections, and Section 3.3 offering Final Considerations.

2 Solution Development

2.1 Definition of Market Assumptions and Hypotheses

2.1.1 Problem Hypothesis

Companies with moderate to high hiring volumes (20+ positions annually) experience significant operational costs and delays due to manual screening, and will invest in automated solutions that demonstrably reduce costs while maintaining quality.

2.1.2 Solution Hypothesis

Autonomous AI agents with real-time voice synthesis can conduct screenings indistinguishable from human interactions. Key assumptions: LLMs can follow structured interview methodologies; voice synthesis quality reaches indistinguishability from humans; real-time processing enables natural conversation; multilingual capabilities maintain consistent quality.

2.1.3 Value Hypothesis

Consumption-based pricing (R\$2.75/minute, R\$1,100 minimum monthly commitment) represents acceptable value. Traditional screening costs R\$3,000-8,000 per hire; a 15-20 minute interview costs R\$41-55, achieving significant ROI within the first month for organizations conducting 20+ screenings monthly.

2.2 Market Sizing and Analysis

2.2.1 Market Size (TAM, SAM, SOM):

1. **TAM:** Latin American HR Management market projects 15.5% CAGR through 2030, exceeding R\$4.5 billion including 10+ million SMEs without recruitment technology;
2. **SAM:** Brazilian recruitment technology market valued at R\$420 million (2024), projected to reach R\$950 million by 2030 (14.2% CAGR);
3. **SOM:** Initial target of 2-3% SAM within 24 months (R\$8-12 million ARR).

2.2.2 Customer Segmentation and Profiling

1. Mid-Market Tech Companies (100-500 employees, 50-150 annual hires): Need speed to improve offer acceptance rates.
2. BPO Centers (500-2,000 employees, 200-500 annual hires): Require scale and cost reduction.
3. Retail/Service Operations (100-300 annual hires): Need 24/7 availability and multilingual support.

2.3 Competitive Analysis and Differentials

Direct Competitors:

- Paradox.ai: 10/10 scheduling automation, WhatsApp integration, limited voice capability;
- HireVue: Enterprise compliance strength, candidate experience criticism;
- Gupy: Brazilian market leader in ATS, legacy technology stack.

Hirefy's Differentiation:

- Real-Time Voice Quality: Fine-tuned Dia model (1.6B parameters) trained on 144 hours of Brazilian Portuguese;
- Behavioral Assessment Integration: Exclusive partnership embedding validated psychological assessment methodology.

2.4 Technological Solution

2.4.1 Requirements and Specifications:

Functional Requirements:

- Autonomous interviews in Portuguese, English, and Spanish;
- Voice synthesis with latency <300ms for natural conversation;
- Structured evaluation reports following behavioral assessment methodology;
- Concurrent interviews without performance degradation;
- SAML integration (Google, Microsoft) for enterprise authentication;
- Job creation workflow with AI assistance.

Non-Functional Requirements:

- System availability >99.5%;
- Voice latency p95 <300ms;
- LGPD compliance;
- Zero-downtime deployments;
- Mobile-responsive interface.

2.4.2 Architecture and Technology:

- **Frontend:** Responsive web application with multilingual support;
- **Backend API:** RESTful services for interview management and evaluation;
- **Voice Engine:** Custom fine-tuned TTS (Dia-based) with ComfyUI integration;
- **Evaluation Engine:** Multi-stage pipeline with proprietary scoring methodology;
- **Authentication:** SAML;
- **Infrastructure:** Cloud deployment with auto-scaling, CI/CD pipeline, monitoring/alerting, backup and disaster recovery.

2.4.3 Development (20 sprints):

1. **Foundation** (Sprints 1-5): Business documentation, interview preparation interface, multilingual landing page, call history interface, 67% page load time reduction;
2. **Market Validation** (Sprint 6): Web Summit Rio 2025 participation, 10 client leads acquired (~R\$216,000 ARR potential), R\$400,000 conditional investment secured;
3. **AI Enhancement** (Sprints 7-9): Harpey AI Assistant for job creation, Dia model fine-tuning for Brazilian Portuguese, voice cloning (5-10 second reference audio), model merging (40/60 weight distribution) addressing catastrophic forgetting;

4. **Enterprise Integration** (Sprints 10-12): Partner business partnership integration, autonomous interview conductor, sequential evaluator agent, REST API, SAML authentication;
5. **Production** (Sprints 13-15): Agent creation systems, deterministic Q&A structure, CI/CD pipeline, zero-downtime deployment, production launch;
6. **Iteration** (Sprints 16-20): Customer feedback implementation, security updates, domain configuration, stakeholder presentations.

2.4.4 Testing and Technical Evaluation:

- Unit testing for core business logic;
- Integration testing for APIs and external services;
- End-to-end testing for interview workflows;
- Performance testing validating <300ms voice latency under load;
- Security testing for authentication and data protection.

2.5 The Business Plan

2.5.1 Market and Competitor Analysis:

Primary customer segments identified through market research:

1. Mid-Market Tech Companies (100-500 employees, 50-150 annual hires): Need speed to improve offer acceptance rates. Primary persona: "Ana, HR Director" managing headcount growth with a small recruiting team, frustrated by losing candidates to faster-moving competitors;
2. BPO Centers (500-2,000 employees, 200-500 annual hires): Require scale and cost reduction for high-volume screening with consistent

quality requirements;

3. Retail/Service Operations (100-300 annual hires): Need 24/7 availability and multilingual support for geographically distributed and seasonal hiring.

SWOT Analysis:

- A. **Strengths:** Superior Brazilian Portuguese voice quality through custom fine-tuning; exclusive partner business partnership providing validated assessment methodology; technical team with demonstrated AI/ML capabilities; early market validation through Web Summit leads.
- B. **Weaknesses:** Limited brand recognition versus established players (Gupy, Paradox); resource constraints typical of early-stage ventures; dependency on single strategic partnership.
- C. **Opportunities:** 530,000 IT professional deficit creating urgent hiring pressure; only 35% SME recruitment technology penetration; government digitalization policy driving investment.
- D. **Threats:** Global players expanding localization efforts; regulatory uncertainty around AI in employment decisions; economic volatility affecting technology spending.

Analysis of Competitors and Product Differentials:

- A. Direct competitors include **Paradox** (10/10 scheduling automation, WhatsApp integration, limited voice capability), **Hirevue** (enterprise compliance strength, candidate experience criticism), and **Gupy**

(Brazilian market leader in ATS, legacy technology stack).

- B. Hirefy's differentiation centers on two pillars: (1) Real-Time Voice Quality through fine-tuned Dia model (1.6B parameters) trained on 144 hours of Brazilian Portuguese, and (2) Behavioral Assessment Integration through exclusive partnership embedding validated psychological assessment methodology.

2.5.2 Business Model (Business Model Canvas - BMC):

- A. **Value Proposition:** Autonomous AI interviews reducing time-to-hire and costs with validated behavioral assessment.
- B. **Customer Segments:** Mid-market tech companies, BPO centers, retail/service operations with 20+ annual hires.
- C. **Channels:** Direct sales, Web Summit and industry event presence, digital marketing, partner business partnership referrals.
- D. **Customer Relationships:** Self-service platform with onboarding support, dedicated account management for enterprise clients.
- E. **Revenue Streams:** Consumption-based billing at R\$2.75/minute with R\$1,100 minimum monthly commitment (400 minutes); enterprise licensing with volume discounts; implementation services R\$5,000-15,000 one-time.
- F. **Key Resources:** Proprietary fine-tuned voice models, partner business methodology integration, technical team expertise, production infrastructure.
- G. **Key Activities:** Platform development and maintenance, model training and optimization, customer success and support, partnership management.

- H. **Key Partnerships:** Partner business (assessment methodology), cloud infrastructure providers, job board integrations.
- I. **Cost Structure:** Engineering team (primary), cloud infrastructure, marketing and sales, partnership royalties.

2.5.3 Marketing and Sales Strategy:

Go-to-Market Strategy:

1. **Months 1-3:** Convert Web Summit leads, establish reference customers, document case studies demonstrating ROI metrics.
2. **Months 4-6:** Expand through partner business client network, targeted digital marketing to technology company HR directors, industry event participation.
3. **Months 7-12:** Scale sales team, expand to additional Latin American markets (Mexico, Colombia, Argentina), develop channel partner program.

Customer Acquisition Strategies: Content marketing establishing thought leadership; SEO optimization for Portuguese-language recruitment technology searches; LinkedIn targeting of HR decision-makers; referral incentives for existing customers.

Customer Retention Strategies: Quarterly business reviews demonstrating ROI metrics; continuous product improvement based on usage analytics; tiered support levels matching customer value.

2.5.4 Financial Projection and Feasibility:

Revenue Model and Pricing Structure:

Consumption-based pricing at R\$2.75/minute of autonomous agent usage with R\$1,100 minimum monthly commitment (equivalent to 400 minutes). Enterprise tier offers volume discounts for high-usage customers plus premium support. Implementation services range from R\$5,000-15,000 one-time.

Projected Expenses and Break-even Point:

At Month 3: 10 customers, MRR R\$11,000, ARR R\$132,000. At Month 6: 30 customers, MRR R\$33,000, ARR R\$396,000. At Month 12: 75 customers, MRR R\$82,500, ARR R\$990,000. At Month 24: 200 customers, MRR R\$220,000, ARR R\$2,640,000.

Break-even target at Month 12 with 45 customers assuming operating costs of R\$50,000/month (team of 5 + infrastructure).

Viability Indicators (estimates): CAC R\$3,000; LTV R\$13,200 (12-month retention); LTV/CAC ratio 4.4x.

2.6 Validation and Results

2.6.1 Validation Methodology:

1. **Event-Based Validation:** Web Summit Rio 2025 participation with dedicated stand, live demonstrations, and direct prospect engagement to test market interest and value proposition resonance.
2. **Pilot Program:** Structured pilot with partner business clients to validate assessment methodology integration and interview quality against established

benchmarks.

3. **Production Deployment:** Live operation enabling real-world usage data collection and iterative improvement based on actual user behavior.
4. **Investor Engagement:** Structured conversations with 7 potential investors to validate business model assumptions and market opportunity assessment.

2.6.2 Market Validation Results:

Collected Data:

Web Summit Rio 2025 outcomes: 100+ stand visitors over event duration; 10 qualified leads representing potential MRR of ~R\$18,000 (ARR ~R\$216,000); R\$400,000 conditional investment commitment.

Customer Feedback:

Strong interest in time-to-hire reduction capability; demand for deeper HR system integrations; request for advanced analytics dashboards for executive reporting; validation of Brazilian Portuguese voice quality advantage over competitors.

Technical Validation:

Voice synthesis indistinguishable from human in blind tests; interview consistency verified against partner business benchmark criteria; multilingual accuracy confirmed for Portuguese, English, and Spanish.

Pivoting or Persisting:

Based on real feedback, the following changes were made to the business model and product:

- Prioritized integration capabilities over additional language support
- Added executive analytics dashboards to product roadmap
- Refined pricing to include enterprise tier for unlimited usage
- Adjusted go-to-market to focus on mid-market tech companies as primary segment

2.6.3 Key Performance Indicators (KPIs):

- A. **Acquisition Metrics** (estimates): Lead-to-customer conversion target 25%; demo-to-trial conversion target 35%; current pipeline 10 qualified leads.
- B. **Usage Metrics** (targets): Monthly interviews per agent 50+; interview completion rate >90%; average interview duration 15-25 minutes.
- C. **Financial Metrics** (estimates): Customer Acquisition Cost (CAC) R\$3,000; Lifetime Value (LTV) R\$13,200; LTV/CAC ratio 4.4x; monthly churn target <5%.

2.6.4 Risks and Mitigation Plan:

- A. **Technology Risk:** Voice synthesis quality degradation presents low probability but high impact. Mitigated through continuous model monitoring and retraining pipeline.
- B. **Legal/Regulatory Risk:** LGPD enforcement actions carry medium probability with high impact. Addressed through legal counsel engagement and privacy-by-design architecture.
- C. **Competitive Risk:** Global player market entry has high probability with medium impact. Counteracted by accelerating local market penetration and

deepening partner business partnership.

- D. **Financial Risk:** Customer acquisition costs exceeding projections present medium probability and medium impact. Mitigated by diversifying acquisition channels and optimizing conversion funnels.
- E. **Partnership Risk:** Partner business partnership termination shows low probability but high impact. Addressed by developing alternative assessment methodology capabilities.
- F. **Market Risk:** Economic downturn reducing hiring volumes carries medium probability and medium impact. Mitigated by expanding to counter-cyclical segments with cost reduction focus.

3 Conclusion

3.1. Achievement of Objectives

The general objective of developing and validating a computational solution for autonomous recruitment interviews was achieved. The platform operates in production, conducting real interviews with validated assessment methodology.

All specific objectives were met:

- A. **MVP Development:** Successfully delivered autonomous interview capabilities in three languages (Brazilian Portuguese, English, Spanish) with natural conversation quality validated through user testing.
- B. **Voice Quality:** Achieved voice synthesis latency under 300ms through custom fine-tuning of the Dia model on 144 hours of Brazilian Portuguese speech data, implementing Speech-to-Speech architecture.

- C. **Market Validation:** Exceeded the target of 10 prospective customers through Web Summit Rio 2025 participation, acquiring 10 qualified leads with potential ARR of R\$216,000 and securing conditional investment commitment of R\$400,000.
- D. **Strategic Partnership:** Established exclusive integration with partner business, embedding validated behavioral assessment methodology into autonomous interviews.
- E. **Revenue Model:** Defined sustainable consumption-based pricing at R\$2.75/minute with R\$1,100 minimum monthly commitment, demonstrating positive unit economics with estimated LTV/CAC ratio of 4.4x.

3.2. Future Projections

- A. **Product Evolution:** HR system integrations (SAP SuccessFactors, Workday, Oracle HCM); advanced analytics dashboards for executive reporting; industry-specific competency frameworks; mobile application for candidate flexibility.
- B. **Technical Advancement:** Multimodal evaluation incorporating video analysis; real-time emotion and engagement detection; integration with emerging LLM capabilities.
- C. **Research Directions:** Longitudinal study of hiring outcomes for AI-screened versus traditionally-screened candidates; bias audit methodology development; candidate perception research on AI interview acceptance.

3.3. Final Considerations

The Brazilian recruitment market of 2025 presents high operational costs versus high strategic potential. Hirefy's Web Summit participation and production deployment demonstrate that autonomous AI agents effectively address this market need.

The project validates that the novel integration of large language models, real-time voice synthesis, and autonomous agents represents a viable approach for transforming recruitment practices. The technical contributions — custom fine-tuning for Brazilian Portuguese voice synthesis using model merging to address catastrophic forgetting, and Speech-to-Speech processing for recruitment interviews — advance the application of AI in high-stakes human decisions.

The business validation methodology combining event-based lead generation, strategic partnership integration, and production deployment demonstrates a viable approach for AI startup market entry in regulated domains.

As HR Tech in Latin America grows at 15.5% CAGR through 2030, ethical, localized AI recruitment solutions represent the definitive competitive advantage for the decade ahead. Hirefy is positioned to capture this opportunity, offering scalability, cost reduction, and improved candidate experience while maintaining standards of consistency and fairness in evaluations.

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