BUSINESS PROPOSAL

Development of a system which predicts and discovers cardiovascular disease (CVD) as well as optimizes the healthcare process.

1. Introduction

Cardiovascular diseases (CVD-s) aka heart diseases are medical conditions that affect the heart and blood. CVD-s are slowly taking the leading position in the list of diseases that cause the highest mortality rate. According to the World Health Organization (WHO)[1] more than 75% of CVD-s deaths occur in low and middle-income countries. Approximately 17.9 million people die from CVD-s each year, accounting for over 30% of all global deaths. Doctors use risk factors to spot early signs of potential CVD candidates some of the factors they are looking into include but are not limited to unhealthy diet, excessive weight, lack of physical activity, smoking, high blood pressure, diabetes as well as genetic predisposition.

One of our members already created a research paper on this topic in which it was concluded the research in this field is at a satisfying level, that there are solutions which are having optimistic accuracy, specificity and sensitivity but that there are not so many practical solutions which are implemented and used in the health care sector[2]. FromHearty is eager to optimize the process of recognition symptoms and diagnosing CVD-s in patients. Our solution starts from simple yet effective so-called quick checks during which a trained AI model collects basic data on patient health in order to recognize the signs of CVD as early as possible. We strive to partner with clinics where CVD tests are conducted in order to further innovate such facilities by providing an AI model that will support the process of recognizing symptoms of CVD. From the very beginning of the project, we defined the thesis that this AI solution should in no way replace experts in the field of CVD, but on the contrary, represent their support and facilitate daily activities, all with the goal of more efficient diagnostics. Therefor we aim to implement our solution in such a way that the assessment and final diagnosis which the patient receives is done by an expert. With continuous feedback we aim to improve our AI solution in terms of accuracy, specificity and sensitivity.

The goal of the project is to develop first and farmouts an API offering AI as a service which public and private hospitals can use in order to modernize their current systems. Furthermore, we want to offer our own healthcare system which, long term, is going to have all functionality needed to help new hospitals get started by offering all necessary functional requirements. Therefor the impact of our solution extends beyond individual health outcomes by aiming to streamline the workflow of healthcare professionals, particularly patients, house doctors and cardiologists by enhancing their ability to provide a more effective way to prioritize those with higher risks of health.

The initiative or project aims to facilitate a broad spectrum of people, making access to healthcare services more equitable and accessible. In this context, "democratization" refers to achieving equality and accessibility for all members of society, regardless of socioeconomic status or other factors. Therefore, the project strives to ensure that as many people as possible can benefit from improvements in healthcare, contributing to the overall goal of achieving equal rights to healthcare.

In conclusion, our initiative is rooted in a deep understanding of the gravity of cardiovascular diseases and the imperative to adopt proactive strategies for prevention and early intervention. The FromHearty application stands as a testament to our commitment to addressing a critical global health challenge and making a tangible impact on the lives of individuals and communities worldwide.

---

[1] Cardiovascular diseases (CVDs)
[2] Application of Artificial Intelligence Toolsin Classification and Diagnosis of Heart Disease: General Review

2. Roadmap

In the strategic development of our healthcare FromHearty application, we have outlined a phased approach to ensure systematic and effective implementation. The project will unfold through distinct phases, each strategically designed to achieve specific milestones and address evolving needs.

1. **Phase I – Initial MVP:**
   - Development
     - Login for family doctor
     - Entry of patient parameters for heart diseases
     - AI CVD Prediction is generated
   - Analysis market with survey to gather info about:
     - facility needs in regard to CVDs
     - facility preferences e.g. parameters used for CVDs
     - challenges which facilities have e.g. in the process of discovering CVDs
     - insights about competition
     - insights about used standards

2. **Phase II – Improvements and testing of MVP:**
   - Development
     - UI/UX is more user friendly
     - UI is usable by color blind people
     - Family doctor can set appointments for the cardiologist
     - E2E tests are setup
     - Login supports roles: cardiologist & family doctor
   - MVP Testing
     - Find pre-alpha users which will test the MVP
     - Gather initial feedback on the prototype

3. **Phase III – Implementations of further feature:**
   - Development:
     - Login for patients is available
     - A more simpler AI so called HeartyBase is trained, based on features such as smoking, drinking alcohol, having diabetes, and is available for the patient to be used
     - Patient Record - all patient information, such as medical history, archive of previous examination results, and other relevant details that will be stored in the patient record.
     - Further e2e tests are written
     - API supports medical system standards such as: HL7, FHIR, etc.
     - Add further functionality to the MVP such as scheduling appointments with specialists
   - Client Acquisition:
     - Implement a strategy to attract and acquire clients for the MVP.

4. **Phase IV – Marketing & smellers features:**
   - Development
     - AIs are improved by the feedback
     - Landing page of our product is created

- o Facility login is available which has functionalities such as
    - Add doctors
    - Register patients
    - Add cardiologists
    - See other facilities
- o Appointment functionality is created
- o Dashboards with reports are available
- o Further e2e tests are available

5. **Phase V – Infrastructure improvements:**
- Development
    - o Optimize functionalities by adding pagination, filters, etc
    - o Infrastructure such as servers and APIs are tested
    - o Long term plan of software architecture is created
    - o Backups for databases are setup
    - o Notifications systematically controlled notifications for reviewing patients who had results near critical levels in previous examinations.
    - o Treatment recommendations (based on the obtained results, generate treatment recommendations for patients)
- Stability and Optimization:
    - o Ensure the stability and optimization of the application for long-term use.
    - o Address any identified issues and optimize performance.
- User Training and Support:
    - o Provide ongoing user training and support to ensure effective utilization of the FromHearty application.
    - o Establish a support system for addressing user inquiries and issues.

6. **Phase VI – Long term improvements:**
- Consultations family doctors can communicate with specialist doctors through the in-app messaging system.
- Integrate with medical devices
- Multi-Classification of CVDs e.g. insights into the sickness
- AI for findings beside CVDs
- Realization of software architecture
- Supper admin functionalities for support
- Alerts generate alerts for emergency cases
- Further improvements of Ais by creating a custom LLM

This phased approach aims to systematically develop, refine, and expand the application over time, aligning with user needs and market dynamics.

3. Technical overview

In the technical realm of our project, we envision a robust implementation aimed at utilizing Microsoft's cutting-edge technologies to bolster our AI-driven healthcare solution. Our application's backbone will be formed by a combination of Angular for the frontend and .NET for the backend,

ensuring a seamless, dynamic, secure and smooth user experience, catering to both patients and healthcare providers.

For the implementation of artificial intelligence (AI) in our diagnostic processes, we've chosen to leverage the ML.NET NuGet package. This package will serve as the cornerstone of our AI capabilities, empowering our application to analyze patient data comprehensively and provide precise and quick diagnoses of cardiovascular diseases. By integrating ML.NET into our system, we're embracing advanced learning algorithms to enhance our diagnostic accuracy, surpassing traditional assessments performed by healthcare professionals. While we adhere to ML.NET, exploring alternatives like TensorFlow could expand our machine learning options.

In essence, our utilization of ML.NET aligns with responsible AI practices by fostering transparency, adaptability, and stringent data security, ensuring that our AI-driven healthcare solution meets ethical standards throughout its deployment.

Furthermore, to ensure the scalability, efficiency, and accessibility of our application, we've opted to host it on Microsoft's Azure cloud platform. Azure will not only provide a robust infrastructure but also enable seamless integration with a myriad of Azure services, fostering real-time communication and data processing.

Mockup-s how the application might look include but are not limited to:

Pic 1. A view for adding patient findings in order to get the AI prediction

Pic 2. Patient info to get a insight into the patient overall information

Pic 3. Appointment Booking
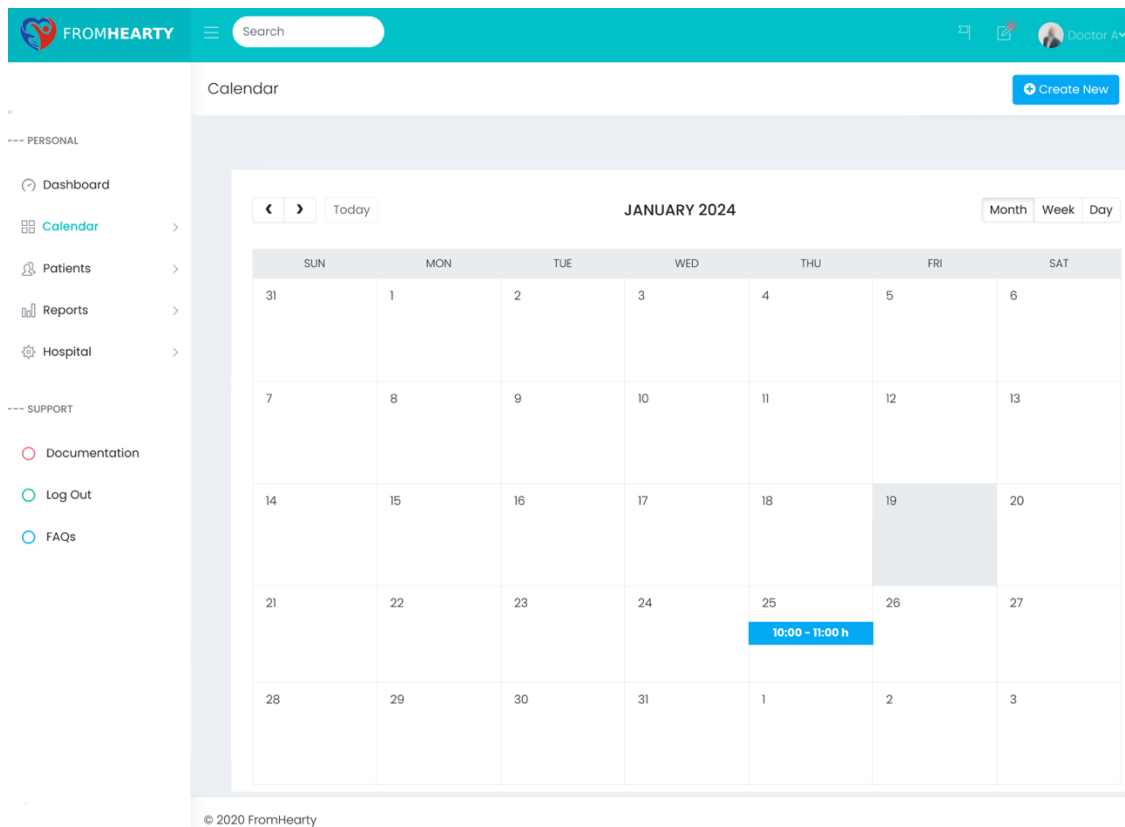
Pic 4. Calendar which can be used in different scenarios e.g. creating appointments

In summary, our technical approach involves the integration of Angular and .NET for the frontend and backend, respectively, coupled with the powerful ML.NET NuGet package for AI-driven diagnostics. Hosted on the Azure cloud platform, our application is poised to revolutionize the approach to cardiovascular health by providing a user-friendly, scalable, and AI-enhanced solution. This technical framework aligns with our overarching goal of addressing the critical global health challenge posed by cardiovascular diseases, as outlined in the introductory section of our project proposal.

4. Target market and users

Considering the fact that cardiovascular diseases occur worldwide and in different age groups, our target market is very broad. In the initial phase of the application implementation, we will focus primarily on healthcare institutions in Bosnia and Herzegovina. The goal is to implement the application in Europe and the USA.

The FromHearty application, working in integration with artificial intelligence, will offer the possibility of being applied to the following groups:

- **Elderly population** (This population has a high risk of developing cardiovascular diseases).
- **Patients diagnosed with heart disease** (The application could be used to monitor the progress of treatment and provide early warning of potential complications).
- **Individuals with excessive body weight** (Body weight is one of the high risks for these diseases. This way, the impact of body weight on heart function can be tracked).
- **Individuals leading stressful lives** (Modern lifestyles often neglect health care).
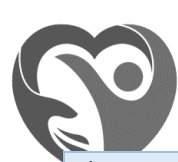
- **Genetic family connections** (Family/genetic connections increase the risk of illness).
- **People living in rural areas** (The application will enable this group of people to receive a higher quality health check-up).
- **Preventive approach, athletes, and others** (Individuals who want to proactively monitor their health status).
- **Public and private clinics** (The application could serve both public and private healthcare facilities).
- **Collaboration with health ministries** (The application may facilitate collaboration with health ministries, promoting its integration into public health initiatives and policies)**.**

5. SWOT analysis

Through the results of the SWOT analysis, we aim to transform our weaknesses into strengths and turn threats into opportunities. We seek to identify ways to minimize our weaknesses, capitalize on opportunities, and prepare for potential threats. The goal of the SWOT analysis is to create a strategy that will guide the development direction of the company.

Strengths	Weaknesses	Opportunities	Threats
Deep Expertise: The project team possesses a unique blend of academic and professional knowledge, ensuring a strong foundation for developing a sophisticated healthcare solution.	**Financial Constraints:** Inadequate funds pose a challenge to the comprehensive development of the application, potentially limiting its features and scalability.	**Rising Demand for Preventive Healthcare:** Growing interest in preventive medical check-ups creates an opportunity to attract more users and reduce the incidence of severe illnesses.	**Competing with Industry Giants:** The presence of dominant multinational corporations poses a challenge to our market presence and growth.
Humanitarian Commitment: Driven by a genuine desire to contribute to reducing mortality from cardiovascular diseases, showcasing a strong sense of social responsibility	**Market Unfamiliarity:** Limited understanding of the medical market may impede the customization of the application to effectively meet the needs of healthcare professionals and patients.	**Cost Savings in Healthcare:** The potential to lower healthcare costs emerges as early detection and preventive measures can lead to reduced expenses associated with treating advanced diseases.	**Data Security Concerns:** Potential apprehensions about the security and privacy of patient data could undermine user trust and pose a barrier to widespread adoption.
Intuitive Diagnostic Tool: FromHearty application stands out as a simple yet powerful diagnostic tool, streamlining the user experience for both healthcare providers and patients		**Efficient Utilization of Resources:** Timely preventive examinations not only offer cost-effective early diagnoses but also optimize resource allocation within the healthcare system, potentially reducing the overall burden on healthcare resources.	**Resistance to AI Adoption:** Some healthcare professionals and individuals may exhibit resistance or skepticism towards AI adoption in healthcare, affecting the widespread acceptance and utilization of the application.
AI Precision: The application leverages advanced AI algorithms, showcasing high accuracy in		**Future Expansion into**	**Limited Rural Accessibility:**

disease analysis, enhancing diagnostic capabilities. **Cost-Effective Implementation:** The low implementation cost allows for widespread adoption, fostering accessibility and inclusivity in healthcare solutions		**Diverse Diagnoses:** Strategic planning includes extending the application's capabilities to diagnose a broader spectrum of diseases, enhancing its long-term relevance and impact.	The application may face challenges in rural areas due to limited digital infrastructure and internet access, restricting its reach to a wider population.

6. General and Project Specific risks

In embarking on the FromHearty AI project, we acknowledge the dual nature of risks — the overarching uncertainties that span the entire landscape of healthcare technology and the intricacies unique to our project's goals and execution. This awareness forms the foundation for a robust risk management strategy, crucial for steering through the complexities that lie ahead.

- **General Risks:**

Technical Risks	Security Risks	Financial Risks	Compliance Risks
1. Technical challenges in implementing AI algorithms. 2. Rapid advancements in AI technology may render current models or technologies obsolete. 3. Need for continuous research and adaptation to stay technologically relevant.	1. Potential leakage and misuse of patients' medical data. 2. System vulnerability to cyber-attacks.	1. Unforeseen costs during development and implementation. 2. Currency fluctuations that may impact overall costs.	1. Possible issues with privacy and medical data regulations. 2. Need for continuous adaptation of the application to new legal standards.

- **Project-Specific Risks:**

User Acceptance	User Training	Lack of Partnerships and Collaboration	Maintenance and Updates	Data Quality and Availability	Patient Privacy Concerns
1. Low user adoption rate of the application. 2. Negative user reaction to	1. Difficulties in training medical professionals to effectively use the AI system.	1. Challenges in establishing partnerships with clinics, physicians, or other healthcare institutions.	1. Challenges in maintaining and updating AI models with new medical knowledge.	1. Dependence on the availability and quality of medical data for training AI models.	1. Addressing concerns related to the privacy of patient health data. 2.Implementation

the use of AI in a medical context.	2. Need for continuous user support during the adoption phase.	2. Need for effective strategies to promote the application among relevant partners.	2. Costs and difficulties in maintaining a high level of accuracy in AI analysis over time.	2. Potential biases in the training data affecting the accuracy of predictions.	of strict measures to protect patient confidentiality and data privacy.

7. Implementation plan

The project development commenced on January 1, 2021, with the creation of a scientific research paper. The development and implementation plan of the application started on January 1, 2024, with the aim of completion by December 31, 2024. During this timeframe, the following activities are planned:

Activity	Duration
Team Assembly;	5 working days
Designing the application (information gathering, application specification, creating design, and database design);	25 working days
Application Development – Phase I (Developing the application using agile methods);	140 working days
Final application testing (Testing all planned functionalities defined in the application specification);	30 working days
Clinical testing of the application in healthcare institutions (Testing the application by physicians in selected healthcare institutions);	45 working days
Analysis and integration of clinical testing results;	15 working days
Formation and training of the support team;	30 working days

It is important to emphasize that the development will be organized using agile software development methods. Thus, before final testing, each component (having a specific functionality) will be tested immediately upon its completion.

8. Marketing plan

The marketing plan is a strategic document outlining activities to promote our product. Our main goal is to achieve a competitive advantage in the market focused on treating cardiovascular diseases.

Objectives:

- Visit a maximum number of different healthcare institutions.
- Educate medical staff about the functionality and benefits of using the FromHearty application.
- Position the FromHearty application as the premier solution in the field of preventive diagnosis of cardiovascular diseases using artificial intelligence.

- Establish collaborations with all healthcare institutions in Bosnia and Herzegovina and abroad.
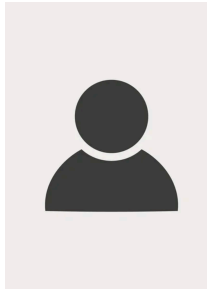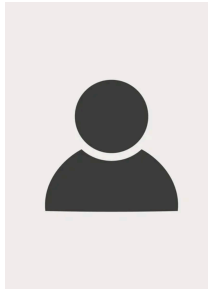
Implementation approach:

- Organize online campaigns on the internet, specifically on platforms dedicated to cardiovascular diseases.
- Create a website, brochures, and flyers.
- Develop articles and videos explaining the advantages of the application.
- Initiate appearances on TV shows focusing on health topics.
- Host webinars and seminars for medical professionals to educate them about the benefits and usage of the application.
- Establish collaborations with major medical centers in the country.
- Focus campaigns on the importance of preventive diagnosis of cardiovascular diseases.
- Engage external partners (physicians) to promote the application through their channels.
- Create reward programs for doctors using the application in their work.

Operational plan:

- Organize a ceremonial launch event for the application in the market targeting a wide audience of healthcare institutions and cardiology professionals.
- Continuously conduct internal education sessions to familiarize doctors with the new features of the application.
- Measure the effectiveness of marketing campaigns and make decisions based on data to achieve better market goals.

9. Team members

The table below provides information about team members, their roles, and the hourly rates for each individual. Current team members include:

Muhamed Karajić	Lejla Hećo	Emir Osmanović	Unknown	Unknown
Solution Architect	Full-stack Developer	Commercial Manager	Marketing manager	Accountant
muhamed.karajic@edu.fit.ba	lejla.heco@edu.fit.ba	emir.osmanovic@edu.fit.ba	-	-

The estimate is based on 290 working days, with 25 working days allocated for design and 140 working days for application development. The IT architect, in addition to the primary task of establishing the system architecture, will also work on the development of the backend part of the application.

Our team of full-stack developers will collaboratively work on all aspects of the application development process, from system architecture design to both frontend and backend implementation.

The marketing manager will be responsible for organizing the marketing campaign leading up to the official application launch date, as well as activities after the event.

Given the startup nature with minimal accounting tasks, team members may share responsibilities, or we may consider hiring an accounting services agency, allowing us to allocate budgeted funds for salaries into product development.

10. Financial plan

In this section, we aim to present a detailed analysis of the financial strategy that will enable us to achieve all business objectives, ensure the successful implementation of planned tasks, and succeed in the market. This is a crucial element of the project that, upon implementation, will ensure long-term stability and profitability.

Startup Costs:

Company Registration	2,800 US Dollars

Gross Salary Costs:

Name	Workdays	Monthly gross salary (US Dollars)	Annual gross salary (US Dollars)
Solution Architect	290	2.351	28.233
Full-stack Developer	290	1.881	22.586
Commercial Manager	290	1.881	22.586
Marketing manager	290	1.568	18.822
Accountant	290	784	9.411
TOTAL:	1450	8.465	101.638

Material Costs:

Name	Price (US Dollars)	Amount	Total
Office	547	12 months	6.564
Computers and equipment	2.739	4	10.956
Small inventory	1.095		1.095
Cleaning services	109	12	1.308
Other expenses (services provided by third parties and all other costs not shown)	5.478		5.478

11. Conclusion

The FromHearty application for diagnosing the risk of cardiovascular diseases, provides an overview of the current possibilities of applying artificial intelligence in medicine. In this way, the application transforms the traditional approach to diagnosing cardiovascular diseases and serves as a valuable tool to aid in the treatment of cardiovascular conditions. With the assistance of artificial intelligence, physicians can diagnose and propose therapy for patient treatment.

The application enables healthcare professionals to utilize advanced tools in patient care, leading to an increase in preventive check-ups and a decrease in neglected patients. This will impact the reduction of the overall treatment cost, and the saved financial resources can be redirected to other priorities.

It is important to emphasize that this application is not intended to replace a doctor but rather serves as a tool to assist them in making decisions regarding patient treatment.