Team Results Document
DetectUs

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9th of August 2024

SensUs

SensUs 2024
Acute Kidney Injury

1. Abstract

Our project focuses on developing a biosensor to monitor creatinine levels, an indicator of kidney function. The biosensor uses a Quartz Crystal Microbalance (QCM) as its core sensing technology, which detects changes in mass on its surface. To achieve specific and continuous detection, we employ an enzyme that reacts with creatinine, changing the frequency of the QCM. This allows us to measure creatinine concentration accurately and continuously as the enzyme can be used multiple times.

The enzyme is attached to the QCM's gold surface using a Biotin-Streptavidin coating, which provides a stable connection and ensures repeatable measurements. This approach is suitable for applications requiring continuous monitoring, such as tracking kidney health in patients over time.

Our biosensor is designed for use in healthcare settings, offering a way to monitor kidney function. By enabling continuous creatinine monitoring, the patient care system can be improved, especially for those patients with chronic kidney disease or in critical care environments. This tool could lead to better-informed treatment decisions.

2. Biosensor

2.1 Molecular recognition

The molecular recognition is based on a bio-layer built on the gold surface of the QCM. The bio-layer coatings consist of Thiol-PEG-Biotin, bound by a Streptavidin molecule, followed by Biotinylated Creatininase. These layers are represented in Figure 1. The active part of this layer is creatininase, the selected enzyme.

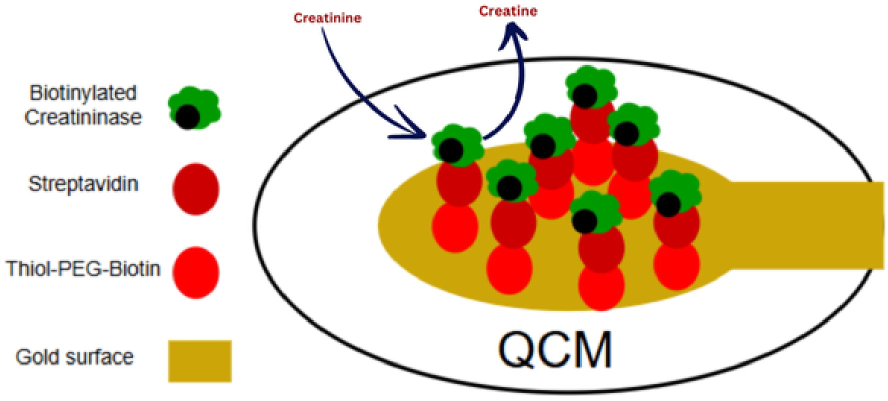


Figure 1: Bio-layer on the gold surface

The intended functionality is that these layers contribute to the sensor's fixed bioactive part. The enzyme is supposed to be fixed, allowing for repeated use and continuous catalysis of creatinine through hydrolysis, thereby producing continuous spikes in the resonant frequency.

Focusing on the **Thiol-PEG-Biotin layer**, the **Thiol group** is an important element, for strong covalent bonds are formed with the gold surface of the QCM. Covalent bonds are better than ionic bonds due to their enhanced stability, greater bond strength, and increased resistance to environmental factors such as pH variations. Additionally, **Biotin** plays an essential role, for a hydrogen bond is formed with the hydroxy group of the **Streptavidin** side chain and the nitrogen (N3) of Biotin. This interaction results in a highly stable and strong hydrogen bond. [1]

Subsequently, creatininase was bio-conjugated with biotin through covalent attachment through an amide linkage. The biotin then forms an additional hydrogen bond with Streptavidin. To conclude, this series of interactions establishes the active bio-layer described above, which is used for the functionalization of the QCM gold surface. This configuration demonstrates how the layer remains fixed and can withstand continuous flow and measurement conditions.

Moreover, by having creatininase ensures that the QCM only detects creatinine, which helps to eliminate potentially interfering substances found in biological fluids like interstitial skin fluid (ISF).

Lastly, it's important to mention that **Thiol-PEG-Biotin** and **Streptavidin** were diluted in PBS buffer**; Biotinylated Creatininase** and **Creatinine** solution for tests were diluted in Mili-Q water.

2.2 Physical Transduction

The physical transduction in the creatinine biosensor system is based on a Quartz Crystal Microbalance (QCM), which measures changes in mass on its surface by detecting shifts in its resonant frequency.

When the sample flows over the QCM sensor, creatinine binds to the enzyme on the sensor surface, leading to an increase in mass for a fraction of a second. This mass change causes a shift in the resonant frequency of the QCM.

The extent of this frequency shift is directly related to the amount of creatinine present in the sample, allowing for accurate measurement of its concentration.

The signal generated by these frequency shifts is processed by a homemade printed circuit board (PCB) designed with a Pierce oscillator circuit. This processed signal is then managed by an ESP32 microcontroller, which measures the resonating frequency. The physical changes (resonating frequency) are then converted into quantitative results, i.e. the concentration of creatinine in mcmol/L of the sample. This is done using a calibration curve and calculations for how the flow speed of the creatinine solution could influence the frequency recorded by the QCM. This calculation will involve the Q factor of the QCM and the surrounding temperature.

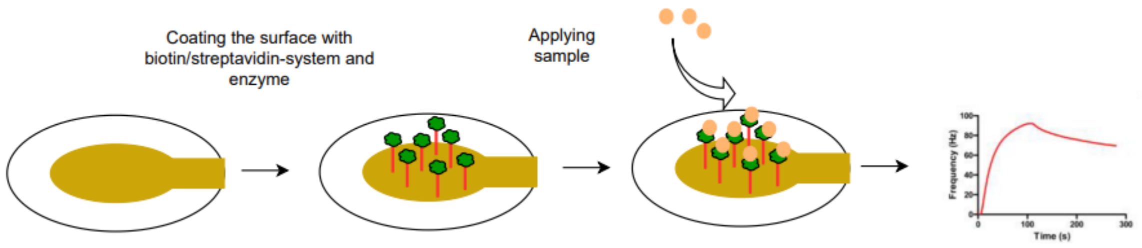


Figure 2: When a sample containing creatinine is introduced into the QCM, the creatinine molecules interact with the enzyme on the sensor surface. This enzymatic reaction results in a change in the local mass on the sensor surface, which is detected by the Quartz Crystal Microbalance (QCM).

2.3 Cartridge technology

The creatinine biosensor system uses a two-layer cartridge design that integrates sample handling, sensor protection, and electronic components.

The top layer houses the flow cell, where the sample fluid is guided over the Quartz Crystal Microbalance (QCM) sensor. The flow cell was built on top of the crystal, creating an empty and sealed cylindrical chamber for the sample, with a capacity of app. 50 µL. The flowcell has one inlet and one outlet, their position was strategically optimized by simulation to increase the sample exchange rate within the chamber, thus achieving an almost complete exchange of old and the newer sample in one minute.

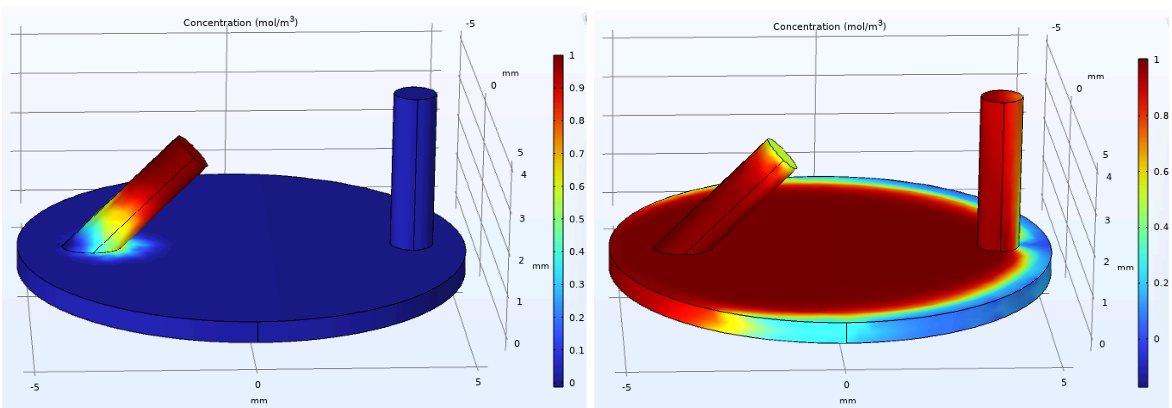
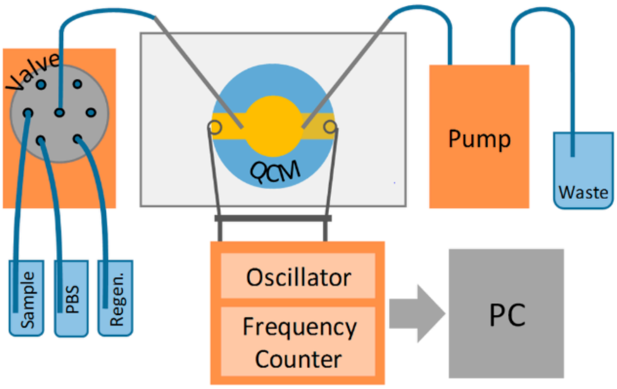


Figure 3: The figures above represent the fluid exchange inside the flowcell, where the blue parts represent the old sample, being exchanged by the new (red) one. First figure, is at time t=0s, and second is at time t=60s.

A syringe pump, also located on the top layer, ensures continuous and consistent flow of the samples across the sensor surface.

The bottom layer is encased in a laser cut acrylic box contains the essential components: a battery, a motor driving the syringe pump through a set of gears used for increasing the torque, an ESP microcontroller for data processing, a PCB for frequency measurement, and the QCM sensor itself.

This cartridge design allows for easy assembly and use, ensuring reliable sample delivery and accurate detection while protecting the sensor and electronics from contamination.



Figures 4: Small overview of how everything fits together

2.4 Reader Instrument and User Interaction

The user-collected data is accessible via an app on the user's smartphone or a website online. Requiring minimal navigation to see results. Furthermore, the app can alert users of dangerous levels of creatinine levels. The user must connect their device to the sensor using bluetooth or a usb connection. Once connected data is transferred to an online database and can be read in the application or website. The user interface is simple and self-explanatory.

In addition to this, a small OLED display on the sensor itself shows important information regarding the measurement, such as resonance frequency, temperature and measured level of creatinine.

The current edition of the device will be around 25x15x15 cm in size, including the sample delivery system. At the moment the device is made for measuring when the QCM is oriented horizontally, as gravity will have an impact on the sensor. This limits the potential for the sensor to become wearable. However, if the device could be coupled with a gyroscope and calibrated for measuring at different angles then the device could be made more wearable.

3. Technological feasibility

The technological feasibility of our continuous creatinine biosensor has been evaluated through a combination of experimental data, model simulations, and theoretical calculations. Here, we critically assess the sensor's potential to achieve the required analytical performance for detecting creatinine in ISF, addressing all 4 key aspects:

3.1 Molecular Recognition Feasibility

To ensure that every coating step in the bio-layer is attached, EIS (Electrochemical Impedance Spectroscopy) method was used after every phase. This means that Impedance was measured after incubating each layer on a Gold surface. The higher the impedance the greater the possibility that the bio-layer is formed in the proper way, with this being said as a layer is added on the gold surface it should be harder for the current to flow therefore impedance should increase with each layer, which can be seen from our results.

Sample	**Impedance (Ohm)**
Negative Control (only PBS)	175 - 295
Sample 1 (Thiol-PEG-Biotin)	598 - 1847
Sample 2 (Thiol-PEG-Biotin + Streptavidin)	1376 - 2106
Sample 3 (Thiol-PEG-Biotin + Streptavidin + Biotinylated Creatininase)	5936 - 8208

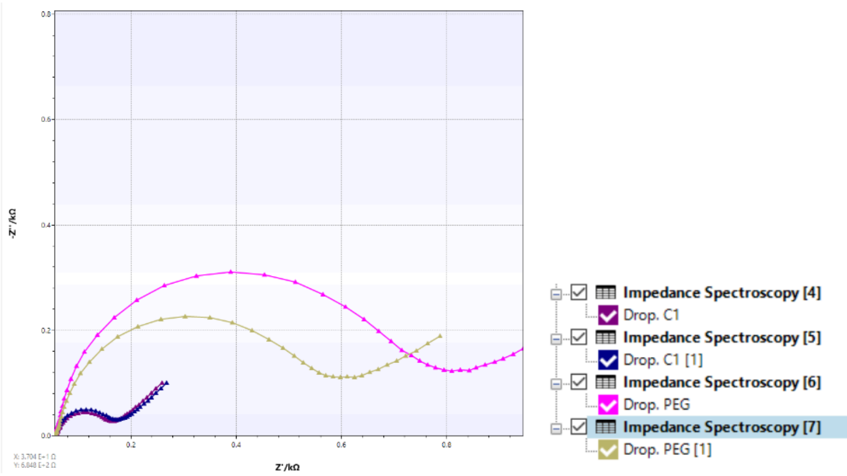


Figure 2: An example of Impedance measurement and how the results are increasing when a new layer is added

Moreover, the bio-layer is tested by using a commercial machine, a QSense Pro from Biolin Company [2]. The objective is to analyze the interaction between the bioassay created and creatinine, and to optimize the procedure of this experiment.

3.2 Physical Transduction Feasibility

The Quartz Crystal Microbalance (QCM) platform used for physical transduction is a well-established method for mass-sensitive biosensing. The frequency shift observed in QCM correlates directly with the mass change on the sensor surface, providing a quantifiable signal proportional to the creatinine concentration.
The prototype shows promise at the ability to detect frequency shifts of the QCM. Future work will focus on enhancing the frequency measurements.

3.3 Cartridge Technology Feasibility

The two-layer cartridge design ensures precise sample handling and protects the sensor and electronic components from contamination. Preliminary tests have shown that the syringe pump system can consistently deliver samples to the QCM sensor surface at controlled flow rates, ensuring accurate measurements. However, the integration of the electronic components, particularly in terms of minimizing electromagnetic interference with the QCM sensor, remains an area for further optimization. The ongoing development includes improving the shielding of the electronic components and refining the layout of the printed circuit board (PCB).

3.4 Reader Instrument Feasibility

The reader instrument, which integrates a PCB, ESP32 microcontroller, and a dual-syringe pump system will together process and analyze the QCM frequency shift and calculate it into a concentration of creatinine.
On the software part of the feasibility we already have a user-friendly graphical interface that can show graphs with the data and on the part with the transmission, we are currently working to send some mock data via Bluetooth from the ESP32 to the website and app.

4. Originality

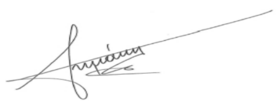
<u>Team supervisor:</u>

‘’I have been supervising the DTU SensUs team, DetectUs, during this year. The students have quite early in the process identified three different sensor concepts that they wanted to work with, with their first choice being a quartz crystal microbalance (QCM) sensor. Since this year’s competition requires continuous measurements, the students decided to modify the QCM surface with enzymes capable of catalyzing creatinine. The enzymatic surface is designed to ensure the longevity of the sensor, while the high sensitivity of the QCM is crucial for accurately measuring the interaction between creatinine and the enzyme.

The combination of enzymatic reactions and QCM is a very novel approach, especially in the format required at the combination (i.e. combined with fluid handling and with minimum interference in between the measurements). I can also confirm that the choice of sensor has been made entirely by the student team themselves. They have studied the literature in order to find workable solutions, both for solving the continuous measurement issues, but also for finding relevant information for making their functionalization protocols, designing their fluid handling system and adding app functionality. They have independently been reaching out to researchers across the different DTU departments in order to get guidance from experts. Finally, they have been very active in the lab, developing each part of the sensor system (i.e. fluid handling, electronics, bio-functionalisation, etc) themselves, only receiving instructions on how to use the equipment and safety training.

In conclusion we have this year a very hard working and remarkably independent team that has come up with a novel biosensor for continuous measurements of creatinine.’’

Sincerely,



Maria Dimaki,

Senior Researcher

DTU Bioengineering

<u>Team:</u>

Our team developed a creatinine biosensor utilizing Quartz Crystal Microbalance (QCM) technology, focusing on continuous monitoring of kidney function. We think this is innovative as we can see a lot of potential that could be discovered by more founding and research into using QCM and make it available for monitoring. As our sensor is trying to scale down a big machine in something that could be portable and used daily. We thought that this idea could be original firstly as using a QCM for continuous measurements as it can give ver accurate measurements due to its high sensitivity. As an extra we thought of using enzymes as the active part rather than antibodies as enzymes can catalyse the reaction forever and therefore is perfect to give a continuous reading, while many sensors use antibodies we decided to take the challenge and use enzymes as it could provide a higher quality sensor in matter of how much time it can continuously measure creatinine before needing to be changed.

5. Translation potential

In the following section we will develop more and talk about how this could biome a real product highlighting the costumes needs, the value of our product and more related to this! Here we included everything that is required in the Translation Potential Rubric.

5.1 Business model canvas

- **Customer Segments**
  - Our target market comprises hospitals, clinics, healthcare organizations, insurance companies, at-risk patients, and health management companies. We aim to address the needs of these diverse stakeholders by providing a solution that improves kidney health management.
- **Value Proposition**
  - We offer a non-invasive, wearable biosensor that enables continuous, real-time monitoring of creatinine levels. This early detection tool empowers patients and healthcare providers to proactively manage kidney disease, leading to improved outcomes and reduced healthcare costs.
- **Customer Relationships**
  - Building strong relationships with healthcare providers and patients is central to our strategy. We prioritize education, support, and open communication to foster trust and loyalty.
- **Channels**
  - We will reach our target market through direct sales, industry conferences, digital marketing, and strategic partnerships. This multi-channel approach ensures maximum visibility and accessibility.
- **Key Partners**
  - Collaborations with medical device manufacturers, healthcare providers, insurance companies, and distribution partners are essential for our success. These partnerships will drive product development, market access, and operational efficiency.
- **Key Activities**
  - Our core operations encompass biosensor development, regulatory compliance, manufacturing, sales, marketing, and customer support. These activities are focused on delivering a high-quality product and ensuring customer satisfaction.
- **Key Resources**
  - Our success hinges on cutting-edge biosensor technology, a skilled team, robust manufacturing capabilities, and strong intellectual property. Adequate funding is essential to support our growth and development.
- **Cost Structure**
  - Key cost drivers include research and development, manufacturing, regulatory compliance, sales and marketing, and customer support. We will focus on optimizing costs through efficient operations and strategic partnerships.
- **Revenue Streams**
  - Multiple revenue streams will drive our business growth, including device sales, subscription-based services, data licensing, and strategic partnerships.

5.2 Stakeholder desirability

5.2.1 Customer and stakeholders

A definition of who the customer is and what their needs are.

Healthcare Providers:

- Nephrologists and Urologists: Specialists who diagnose and monitor kidney function.
- General Practitioners: Primary care doctors who perform regular health check-ups.
- Diagnostic Laboratories: Facilities that conduct various medical tests, including kidney function assessments.
- Hospitals and Clinics: Medical facilities providing inpatient and outpatient care.
- Home Healthcare Services: Providers offering home-based patient care, especially for those with chronic conditions.

Individual Consumers:

- Chronic Kidney Disease Patients: Individuals requiring continuous monitoring of kidney function.
- Elderly Population: Seniors who need regular health assessments.
- Health-Conscious Individuals: People interested in preventive health measuress

Customer Needs:

- Accurate and Rapid Diagnosis: Quick and precise measurement of creatinine levels to facilitate timely medical intervention.
- Ease of Use: User-friendly design suitable for healthcare professionals and individual consumers.
- Cost-Effectiveness: Affordable testing solution to reduce healthcare costs for providers and patients.
- Portability: Compact device that can be easily transported for use in various settings, including home care.
- Real-Time Monitoring: Continuous assessment of creatinine levels for proactive health management.
- Non-Invasive Testing: Minimal discomfort for patients during sample collection and analysis.
- Regulatory Compliance: Assurance of adherence to healthcare standards and guidelines

The key characteristics of profitable customers

- Financial Capacity: Ability to invest in diagnostic equipment for healthcare improvement.
- Long-Term Commitment: Willingness to engage in ongoing purchases and maintenance.
- Emphasis on Quality Care: Focus on improving patient outcomes through reliable testing solutions.
- Alignment with Healthcare Trends: Support for innovative, cost-effective, and efficient healthcare practices.

An explanation of what the added value of the product will be for the customer.

Reliability is crucial in this sector - without a reliable solution, all other value-adds are worthless. That is why reliability has been at the top of our list while developing our sensor. This entails high accuracy readings, always. On top of this, our solution is essentially an IoT device, which opens up for integration with healthcare systems. Making life easier for all our customers, as the results can be monitored remotely and the data can easily be collected for further analysis.

Furthermore, early detection of increased creatinine levels can lead to lives saved. Continuous monitoring allows persons at risk to feel safer in their everyday lives, which is a crucial value-add.

A definition of who the stakeholders are and what their needs are.

Stakeholders and their needs:

- *Patients: Need accurate, rapid diagnostics, affordability, and ease of use.*
- *Doctors and Healthcare Providers: Require reliable tools, streamlined workflows, and compliance.*
- *Hospital Management: Seek cost-effectiveness, efficiency, and patient satisfaction.*
- *Insurance Companies: Aim for reduced costs, improved outcomes, and preventive care.*
- *Regulatory Bodies: Demand compliance, safety, and efficacy.*
- *Investors: Look for ROI, market potential, and innovation.*
- *Distributors/Retailers: Need demand, pricing, and support.*
- *Government/Public Health: Desire improved outcomes, affordability, and compliance.*

An analysis of the relationship between the product and each stakeholder (patients, doctors, hospital management, insurance, tax-payers, etc.)

- Patients: Directly benefits from accurate diagnostics, improving health outcomes.
- Doctors/Healthcare Providers: Facilitates decision-making and care.
- Hospital Management: Optimizes resources, costs, and satisfaction.
- Insurance Companies: Promotes preventive care, cost-efficiency, and claims.
- Regulatory Bodies: Ensures compliance, safety, and trust.
- Investors: Offers market potential, innovation, and ROI.
- Distributors/Retailers: Provides demand, pricing, and support.
- Government/Public Health: Supports initiatives, detection, and policies.
- Research Institutions: Facilitates research, collaboration, and innovation.

A consideration of the rules and regulations while dealing with each stakeholder.

- Patients: Privacy, data protection, informed consent.
- Healthcare Providers: Medical device regulations, clinical guidelines.
- Hospital Management: Procurement, safety standards.
- Insurance Companies: Billing, preventive care.
- Regulatory Bodies: Certification, surveillance.
- Investors: Financial regulations, transparency.
- Distributors/Retailers: Supply chain, labeling.
- Government/Public Health: Policy, reporting.
- Research Institutions: Ethical standards, collaboration.

5.2.2 Value proposition

An analysis of competitors and their products.

Roche - Cobas C systems: The Cobas c systems/models vary in size and capabilities depending on the need/size of the laboratory. Their most compact offering is the Cobas c 111 - which can process up to 50 samples in a day, and it works both with blood serum and urine. However, it comes with high initial investment cost, and a bulkier design. It also requires prior lab knowledge.

Abbott - i-STAT System with the CREA Cartridge: The i-STAT system is a handheld device for blood analysis, including creatinine measurement with the specific cartridge. The strengths of this system include: Portability due to it being handheld, enabling point-of-care testing. It has a relatively quick turnaround time with results available in minutes. However there are some apparent weaknesses which include expensive cartridges and maintenance costs, due to complexity it should only be used by healthcare professionals. Blood samples must be taken in order to get a measurement.

Honorable mentions: StatSensor Creatinine Meter(Novo Biomedical) and Clinitek Status Plus (Siemens)

A comparison between the team's and the competitor's product.

Technology and Detection: Our biosensor utilizes Quartz Crystal Microbalance (QCM) technology with enzyme-based detection, providing superior sensitivity and specificity. In contrast, Roche's Cobas c 111 uses photometric methods, and Abbott's i-STAT System relies on electrochemical sensors, which may not offer the same precision and are subject to interference from sample constituents.
Portability and Cost-Effectiveness: The compact design of the team's biosensor offers high portability, ideal for point-of-care testing, making it more accessible and cost-effective than the bulky Cobas c 111, which is limited to laboratory settings. Although Abbott's i-STAT System is portable, the team's biosensor stands out with its lightweight design, competitive pricing, and low consumable usage, making it more economical for routine and frequent testing.
Real-Time Monitoring and Versatility: The team's biosensor offers continuous real-time monitoring, providing an edge in chronic kidney disease management. This is a significant advantage over Roche's discrete testing approach and Abbott's limited monitoring capabilities.

The intellectual property of competitors in relation to the team's product.

The portable biosensor's IP portfolio demonstrates significant differentiation from Roche's Cobas c 111 and Abbott's i-STAT System. By leveraging proprietary technologies in enzyme-based detection, QCM platform, compact design, and advanced connectivity, the biosensor technology differs greatly from the underlying IP leveraged by our competitors.

An explanation of how the team will go about their monetary valuation process.

The monetary valuation of our biosensor involves a multifaceted approach to assess its worth accurately. We consider various financial models and market factors to establish a realistic valuation that reflects the product's market potential and competitive advantages. This process involves the following(shortened):

- Market Analysis: Assess size, trends, and competitive landscape.
- Cost Analysis: Calculate production, distribution, and pricing.
- Revenue Projections: Forecast sales, streams, and profits.
- IP Valuation: Evaluate patents, licensing, and differentiation.
- Risk Assessment: Consider regulatory, market, and operational risks.
- Investment Needs: Identify capital, investor interest, and funding.
- Valuation Models: Use DCF, CCA, and precedents for estimation.

An outline of the degree to which the prototype lives up to the benefits described earlier (e.g.user-friendliness,size, speed, data communication)

Even right now in this state, the sensor might not be as wearable, but it still can confirm some of the above statements, it detects the creatinine levels fast and continuously as it is enzyme-based QCM therefore due to the fast enzyme reaction and its longevity. Also, by offering Bluetooth and cable connectivity, our sensor is very user-friendly as they can connect to different phones and the data can be transmitted and processed in real time.

5.2.3 Support

We have interviewed Christian Meyhoff - Founder of WARD 247 and Head of Research at Bispebjerg Hospital. We have also interviewed Casper Riedel - who has worked both in the department of Neurosurgery at Rigshospitalet and at the Radiology department at Amager & Hvidovre hospital. Furthermore, two of our team members have a MedTech startup and have provided knowledge.

5.3 Business feasibility

5.3.1 Key resources & activities

- **Technical Expertises**
  - Our team possesses strong expertise in biosensor technology, enzyme chemistry, and data integration. We partner with universities and research institutions provide access to advanced research and development facilities. Finally, we can use training programs and hiring plans to expand the technical team as needed.
- **Manufacturing Facilities**
  - Initial production can be handled through our existing pilot manufacturing setup. Furthermore, contract manufacturers are available for large-scale production if demand exceeds current capacity. Finally, we plan to build/buy or expand facilities with automation capabilities to meet increasing production needs.

Here are the headlines of other key resources: Supply Chain Management, Regulatory Expertise, Financial Resources, Marketing & Sales, IP.

5.3.2 Key partners

We would benefit greatly from collaborations with systems like Ward 247 - which essentially creates a single dashboard showing measurements from multiple systems/devices. Especially if we follow the current trend in medical devices, there is an increase in wearable systems that measure either continuously or at certain intervals. Our product and software works well as a standalone system but would be even better if it could be integrated into existing solutions. No user or health professional wishes to use different dashboards depending on what they are measuring.Ward 247 would become more attractive for hospitals and healthcare professionals the wider the use-cases are. This ensures that both companies like Ward 247 and our team would benefit from a collaboration.

5.3.3 Sustainability

The biosensor minimizes environmental impact by reducing waste and energy consumption. The device's efficiency and limited reliance on consumables contribute to eco-friendly healthcare practices. Compared to our previously mentioned competitors, our product does not rely on single-use components for every measurement, this making the product more sustainable, plus materials for production could be recycled from prototypes or broken parts. A buy-back option could be available in order to promote sustainability.

5.3.4 Coherence of the business model

Alignment with Value Proposition:

- Resources and Activities: Our team's expertise and key activities in biosensor development align with delivering a sensitive, portable, and cost-effective creatinine detection solution.
- Partners: Collaborations with healthcare providers and existing systems support scalability and product delivery.

Distribution channels

- Direct Sales: The hospital sector is famed for being hard to penetrate. Still making an effort with direct sales is worth a go as our product will be too great to dismiss.

- Partnerships: Like mentioned above, partnering with systems that already integrate IoT medical devices into a single dashboard can be crucial for scaling our sales.

6. Team and support

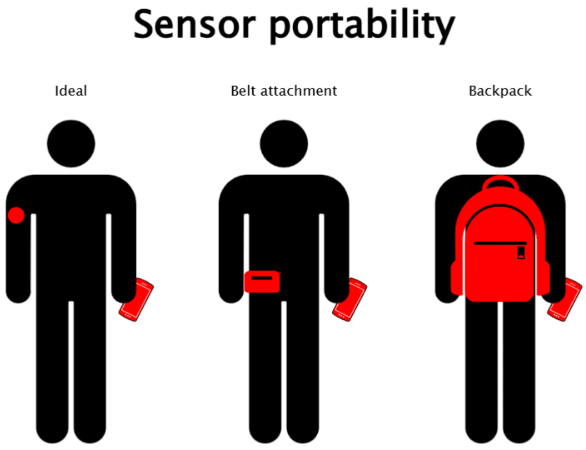
Our team is divided into an online team which will not attend the Eindhoven innovation days and the physical team.

Physical Team	Agrim Bhatnagar - Software main and business +PR + biology team helper
	Anne Sophie Munch - Electronics helper
	Cezara Bălăţel (Team co-capitan) - Biology main + Administration + Flow cell and Fluidics helper
	Gabriela-Georgeana Vieriu (Team co-capitan) - Administration + Found management + PR main and Biology + Software helper
	Kåre Appel Mondrup - Electronics main and Flow cell and Fluidics + Software helper
	Louise Horsmans Schultz - Electronics helper
	Maxim Crucirescu - Flow cell and Fluidics + Simulation main and Electronics + Biology helper
	Philip Vestergaard-laustsen - Electronics main
	Rahima Akhter - Biology helper
Online Team	Arthur Herbosch - Buisness and PR main
	Joachim Rønsholt - Buisness and PR main
	Katarzyna Korus - Biology helper
	Ola Dybvadskog - Buisness and PR main

Support:
Christian Vinther Bertelsen: Biology Adviser, Safety Consultant
Maria Dimaki: COMSOL Simulation
Daniel-Ștefan Cristea: EIS, Safety Consultant, Enzyme Activity
Jacob Aunstrup Larsen: QCM machine
Pulkit Saluja: Mechanical and Fluid System Consultant
Anas Mohamad Al Shalyan: PCB design and SMD mounting
Gustav Kildevang Modler: 3D design, Resin 3D printing

7. Final Remarks

For future development, creating a more portable bio-sensor, ideally resembling an arm patch, would be a one of the main goals.



Additionally, an important thing to mention is that if the QCM results are going to be favorable, then the biosensor idea presented by our team will be a much cheaper version of the commercial QCM machine QSense Pro which costs between $80.000 - $100.000 USD. Our biosensor will cost around $1000 - $2000 USD and it will be fully portable and easy to use for a continuous measurement. This again improves accessibility and equity for a good healthcare system. To achieve this we will concentrate on reducing the cost and invasiveness of our sensor. Improved accessibility will allow us to help more people and create a bigger positive impact in the world.

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