Final Review Report

AI based System for Automated Report Generation from CBCT Scans for Tooth Implantation

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Overall Assessment

25.8% (20.6 / 80)

★☆☆☆☆

Sections	Strengths	Weaknesses	Recommendations
8	4	5	6

Executive Summary

This proposal addresses a significant and clinically relevant problem: the automation of report generation from CBCT scans to improve efficiency in dental implant planning. The project's focus on applied AI in healthcare is well-aligned with the strategic priorities of the Anusandhan National Research Foundation (ANRF). The concept of creating a tool that produces patient-friendly reports is particularly commendable, as it demonstrates a focus on tangible, real-world impact.

However, the proposal is severely undermined by pervasive and critical deficiencies across nearly every section. It suffers from a systemic lack of specificity, rendering it impossible to properly evaluate its scientific merit, innovation, or feasibility. The objectives are not defined, the methodology is vague, the timeline is incoherent, and the budget is incomplete and unjustified. Furthermore, the questionable relevance of the Principal Investigator's expertise, combined with unrealistic claims of creating a fully autonomous system and a complete disregard for ethical and regulatory considerations, fundamentally damages the proposal's credibility.

In its current state, the proposal reads as a preliminary idea rather than a well-developed research plan. The cumulative weight of these weaknesses presents an unacceptably high risk to the funder. Therefore, this proposal is not recommended for funding. A complete and fundamental revision is required before it can be considered competitive.

Major Strengths

- ✔ Identification of a Clinically Relevant Problem: The proposal correctly identifies the time-consuming nature of manual CBCT scan analysis for dental implantation as a significant bottleneck in clinical workflows.
- ✔ Alignment with Funder's Strategic Priorities: The project's topic, leveraging AI for healthcare innovation, is in strong alignment with the thematic scope of the ANRF.
- ✔ Logical High-Level Project Structure: Despite a lack of detail, the methodology follows a logical sequence of high-level phases (data acquisition, model development, evaluation), indicating a basic conceptual framework for the project.
- ✔ Commendable Focus on End-User Impact: The stated aim to generate 'patient-friendly reports' is a notable strength, suggesting consideration for practical usability and impact beyond a purely technical output for clinicians.

Major Weaknesses

- ✖ Absence of a Concrete and Evaluable Research Plan: The proposal lacks specific, measurable objectives and well-defined outcomes. The methodology is described in vague, non-standard terms, making it impossible to assess the technical approach, novelty, or soundness.

- ✗ Critically Inadequate Project and Resource Management: The budget is fundamentally flawed, with unjustified costs and the fatal omission of essential resources like high-performance computing (GPUs). The project timeline is incoherent and lacks the detail required to demonstrate feasibility.
- ✗ Questionable Team Capability and Expertise Alignment: The proposal fails to demonstrate that the Principal Investigator possesses the requisite expertise in medical imaging AI and/or dentistry. The provided credentials show a significant disconnect from the proposed research area, with no mention of collaborators to fill these critical expertise gaps.
- ✗ Poor Scientific Credibility and Unrealistic Claims: The document is hampered by poor writing and the unrealistic, ethically questionable goal of creating a system that functions 'without the intervention of a clinician.' This, coupled with unsubstantiated claims of novelty, severely undermines the project's credibility.
- ✗ Complete Omission of Ethical and Regulatory Framework: For a project involving sensitive patient medical data, the absence of any discussion regarding ethics board approval, data privacy, patient consent, and potential regulatory pathways is a fatal oversight.

Cross-Sectional Recommendations

- → Formulate SMART Objectives and Measurable Outcomes: Revise the objectives to be Specific, Measurable, Achievable, Relevant, and Time-bound. Each objective must be tied to a concrete deliverable and a quantitative success metric (e.g., 'Achieve a Dice similarity coefficient of >0.90 for mandibular bone segmentation on the validation dataset').
- → Provide a Detailed and Justified Technical Methodology: Specify the exact AI architectures to be explored (e.g., U-Net, Transformers), justify their choice against the state-of-the-art, and detail the data preprocessing, training, and validation protocols. Substantiate all claims of novelty with citations.
- → Rebuild the Budget, Timeline, and Risk Analysis: Develop a detailed, bottom-up budget justifying every line item, including a clear plan for acquiring necessary computational hardware. Create a realistic project timeline (e.g., a Gantt chart) with clear tasks, dependencies, and milestones. The risk analysis must be expanded to meaningfully address model bias, data privacy, regulatory hurdles, and clinical integration challenges.
- → Strengthen the Team and Demonstrate Relevant Expertise: The proposal must explicitly demonstrate the team's capacity to execute the project. This

requires either highlighting the PI's directly relevant experience or, more critically, including Co-Investigators or formal collaborators with documented expertise in medical AI, CBCT imaging, and clinical dentistry.

- → Integrate a Robust Ethical and Regulatory Plan: A dedicated section must be added that details the strategy for obtaining Institutional Review Board (IRB) approval, ensuring data anonymization and security, and outlines a potential pathway for clinical validation and regulatory engagement.
- → Ground the Project in Clinical Reality: Re-frame the project's ambition to be a 'clinical decision-support tool' that assists, rather than replaces, the clinician. This is a more realistic, ethically sound, and fundable objective. The entire proposal should be professionally edited for clarity and precision.

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Section Score Legend:

80-100% - Excellent

60-79% - Good

40-59% - Needs Improvement

0-39% - Inadequate

Section Scores

SECTION	SCORE	RATING	VERSION
Abstract	2.1/10	★☆☆☆☆	v1
Objectives	1.5/10	★☆☆☆☆	v1
Methodology	3.0/10	★★☆☆☆	v1
Budget Justification	3.0/10	★★☆☆☆	v1
Team Expertise	2.5/10	★☆☆☆☆	v1
Expected Outcomes	4.0/10	★★☆☆☆	v1
Risk & Mitigation	2.5/10	★☆☆☆☆	v1
Project Timeline	2.0/10	★☆☆☆☆	v1
Overall	20.6/80	★☆☆☆☆	25.8%

Abstract

Score: 2.1/10

Section Content

Version 1

CBCT scans for tooth implantation assessment performs a vital role. These scans are able to present the three dimensional (3D) view of the captured images of tooth under consideration. The details present in these scans are able to check the quality of the bone and the tooth to be considered for implantation process. These scans are able to generate the idea about the possibility of the happening of the successful implant. After scanning or generation, these CBCT images required the attention of an expert to mark the different locations of interest like Crest, IAN Canal, Nasal Floor etc. These locations further helps in the generation of idea abort the quantitative parameter i.e. Height, existing among these located points. These heights will be used next to extract the idea about the different levels of Lekholm & Zarb and Misch classifications. This basically summarize the overall report by introducing the qualitative parameters. The proposed system will be able to generate the automated medical reports for tooth implantation process rather than the manual procedure explained above. The input to the system will be considered as the CBCT (Cone Beam Computed Tomography) scans. The proposed system will reduce the requirement of sending these scans to the medical expert for the marking of different regions of interests. These regions further with the help of knowledge based system carried by the expert to conclude the implantation possibilities of the tooth under consideration. The major research questions addressed by the proposed system is the identification of upper and lower jaw from CBCT scans. Then the segmentation of tooth area and the bone area form these scans. With the help of artificial intelligence model these areas will be identified. For the quantitative assessment, different heights such as crest to sinus floor, crest to IAN floor etc. will be calculated. These quantitative values further will help in the qualitative analysis of tooth and bone by considering Lekholm & Zarb and Misch classifications. The major challenges involved in this work are the collection of CBCT scans, Segmentation of various region of interests, identification of the specific section of the CBCT data to make observations regarding the quantitative measures. AI based model is also required to deal with the automatic generation of reports. The automatic generation of medical report without the intervention of clinician or doctor from the CBCT dental scans is the novel aspect associated with the proposed system. The segmentation of specific point of interest such as crest, nasal floor, IAN canal etc. leads to the

selection of appropriate level of also leads to the level of Lekholm & Zarb and Misch classifications. This further help in the generation of a summary report which will be easily understandable by the patients and their family members.

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Summary

The proposal addresses a clinically relevant problem: the manual, time-consuming analysis of CBCT scans for dental implant planning. The proposed AI-driven system to automate this workflow is thematically aligned with the ANRF's strategic interests in applied AI and healthcare innovation. The project's aim to generate patient-friendly reports is a commendable aspect that focuses on tangible user benefits. However, the abstract is severely undermined by a lack of clarity, poor grammatical structure, and repetitive, convoluted phrasing. This significantly obscures the scientific and technical merit of the proposal and raises serious concerns about the principal investigator's ability to communicate research findings effectively. The technical approach is described in vague terms (e.g., "artificial intelligence model"), and the ambitious claim of creating a system that functions entirely "without the intervention of clinician or doctor" is unrealistic and ethically questionable. Such a claim undermines the credibility of the proposal, as a decision-support tool is a far more feasible and responsible objective. The abstract fails to substantiate its claims of novelty, leaving the reviewer unable to assess the project's true contribution to the field.

Strengths

- Addresses a significant and practical problem in clinical dentistry, with potential to improve workflow efficiency.
- The project topic is well-aligned with national research priorities in AI and healthcare technology.
- The stated goal of generating a summary report easily understandable by patients is a strong, impact-focused feature.
- The proposed workflow, from scan to classification, demonstrates a clear, albeit ambitious, end-to-end vision.

Weaknesses

- Extremely poor writing quality with grammatical errors and convoluted sentences severely hinders comprehension and damages credibility.
- The technical methodology is exceptionally vague, using generic terms like "artificial intelligence model" without specifying architectures, techniques, or datasets.
- The claim of novelty is asserted but not justified. The abstract does not position the work within the state-of-the-art to demonstrate a clear research gap.
- The stated goal of complete automation without any clinician intervention is unrealistic and medically irresponsible. This overstatement of capability significantly weakens the proposal.
- The problem statement and potential impact are not quantified, lacking specific data on the current workflow's limitations (e.g., time, cost, error rates) that would justify the investment.
- The abstract is poorly structured and highly repetitive, failing to present a concise and compelling case for funding.

Recommendations

- → The abstract must be completely rewritten for clarity, conciseness, and adherence to academic standards of writing. A logical structure (Problem, Methods, Novelty, Impact) should be followed.
- → Reframe the primary objective to be a 'clinical decision support system' that assists radiologists and surgeons. This is a more credible, fundable, and responsible goal than full clinician replacement.
- → Provide specific details on the proposed AI methodology. For instance, state the types of deep learning models to be explored (e.g., 'U-Net or transformer-based architectures for landmark segmentation').
- → Clearly articulate the innovation. Explicitly state how this work advances beyond existing research. For example: 'While prior models segment the IAN, our novelty lies in the integrated classification of bone quality based on Misch criteria and the automated generation of a structured report.'
- → Strengthen the problem statement with data. Cite statistics on the number of implant procedures, typical analysis time for a CBCT scan, or documented inter-observer variability to build a stronger rationale.
- → Refine the 'research questions' to be more than just technical steps. Frame them as genuine scientific inquiries, e.g., 'To what degree can an automated

system reliably replicate expert-level measurements of bone height and density from CBCT scans?'

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Objectives

Score: 1.5/10

Section Content

Version 1

- Data Acquisition and Pre-Processing
- Model Development and Training
- User Study and Evaluation
- Dissemination and Reporting

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Summary

The provided objectives are critically underdeveloped and represent a significant weakness in the proposal. They are presented as high-level work package titles rather than specific, measurable, and outcome-oriented research goals. This lack of specificity makes it impossible to evaluate the project's scientific rigor, feasibility, or potential for innovation. While the sequence of tasks is logical, the failure to define clear endpoints, metrics, or targets suggests the research plan has not been sufficiently thought through, posing a major risk to the funder and undermining confidence in the project's potential for success.

Strengths

- The objectives are listed in a logical, chronological sequence that reflects a standard research and development workflow (i.e., data acquisition, model development, evaluation).
- The thematic areas identified (data, modeling, user study) are relevant and necessary components for a project of this nature.

Weaknesses

- **Lack of Specificity and Measurability:** The objectives are headings, not goals. For instance, 'Model Development and Training' fails to specify the

type of model, the target performance metrics (e.g., segmentation accuracy, report quality score), or the criteria for completion. This is a fundamental flaw.

- **Failure to Define Scope:** The proposal does not quantify any aspect of the project. There is no mention of the size of the dataset to be acquired, the number of users for the study, or the specific anatomical structures and pathologies the AI will report on.
- **Conflation of Research Objectives with Project Management Tasks:** 'Dissemination and Reporting' is a project management and impact activity, not a core research objective. Its inclusion here suggests a misunderstanding of how to frame a research plan.
- **Inability to Assess Innovation:** Due to the extreme vagueness, it is impossible to determine what is novel about the proposed approach. The innovation could be in the data, the model architecture, or the evaluation method, but none of this is articulated.

Recommendations

→ **Reframe into SMART Objectives:** Each objective must be rewritten to be Specific, Measurable, Achievable, Relevant, and Time-bound. For example, 'Data Acquisition and Pre-Processing' should be reformulated as: 'To curate and annotate a dataset of 500 anonymized CBCT scans, achieving inter-rater reliability of $\kappa > 0.85$ for key landmarks (mandibular canal, maxillary sinus)'.

→ **Quantify Targets and Metrics:** Define clear, quantitative success criteria for each objective. For 'Model Development', specify the target AI performance (e.g., 'achieve a Dice coefficient of >0.92 for mandibular canal segmentation' and 'generate reports with a BLEU score >0.8 when compared to radiologist reports').

→ **Focus on Research Outcomes:** The objectives section should be limited to the core scientific and technical goals. Activities like dissemination should be detailed in a separate 'Impact' or 'Dissemination Plan' section, linked to the successful achievement of the research objectives.

→ **Explicitly State the Novelty:** The objectives should be written to highlight the project's innovative contribution. For example: 'To pioneer a novel attention-based transformer model for directly generating structured narrative reports from 3D volumetric data, bypassing intermediate segmentation steps.'

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Methodology

Score: 3.0/10

Section Content

Version 1

8. Research Methodology(600 words)
The following interrelated phases will be used to carry out the project:
Phase-1: Data Acquisition: The collection of CBCT scans and reports is required to be done in this phase. This is the most crucial phase of the proposed project. The first milestone in this phase is make an agreement with the medical clinician or the data center from which the CBCT scans needs to be collected. Milestone-II of this phase is to collect 1200 CBCT scans of different patient which fall under the different levels of lekholm and zarb or Mich classifications. This phase also deals with the pre-processing task on these collected scan to handle the issue of poisonous noise, Thermal noise and the Ring Artifacts produced during the scanning process under CBCT scans.
Phase-2: Model Development and Training: During this phase we will develop a model to deal with the process of segmentation and identification of the different regions of interests. The segmentation needs to be done to locate the regions of lower jaw and upper jaw means Mandible and Maxilla. After that the segmentation needs to be carried out at the level of tooth identification and bone density identification. The Milestone-1 in this phase deals with the implementation of self training algorithm to extract the regions of Mandible and Maxilla. After this the identification of tooth under consideration along with the information about its particular section in CBCT scan is performed. Milestone-2 under this phase is to train the system over CBCT reports considered for the training phase. Milestone-3 under phase-2 is to evaluate the model as per different validation sets.
Phase-3: User study and Evaluation: This phase is involved with the evaluation part of identified points in tooth and bone regions such as Nasal Floor, IAN Cannel, Crest regions. This first milestone is to find out the quantitative measures as the heights form crest to nasal floor, crest to IAN floor etc. These heights and the desired sections of the tooth under consideration will be identified. The milestone-2 in this phase is to extract the information about the qualitative measures like lekholm and zarb or Mich classifications. This leads to the idea about the qualitative measure of the bone quality to find the status of the implantation process or the possibility of the implantation.

Phase-4: Dissemination and Reporting: This phase is involved with the writing of

the final report after the compilation of all the results and findings. This process involved with the publication of articles related to the findings of different phases for the sake of approval from the publishing agencies and exposure of the findings to the outside word.

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Summary

The proposed methodology outlines a logical, phased approach to the project, starting from data acquisition and moving through model development to evaluation. The identification of a specific data acquisition target (1200 CBCT scans with defined bone classifications) is a notable strength. However, the proposal suffers from a critical lack of technical depth and specificity across all phases, which severely undermines its credibility and feasibility. The description of the core AI techniques is exceptionally vague, using non-standard terminology and failing to name or justify specific algorithms for segmentation, classification, or the central task of report generation. This lack of rigor makes it impossible to assess the technical soundness or innovation of the proposed work. Furthermore, the complete absence of ethical considerations for handling sensitive patient data, coupled with no discussion of limitations or contingency plans, represents a significant oversight for a project of this nature. While the high-level structure is sound, the core scientific and technical details are missing, rendering the methodology weak and unconvincing from a funder's perspective.

Strengths

- The methodology is structured into clear, logical phases (Data Acquisition, Model Development, Evaluation).
- The data acquisition plan specifies a target number of scans (1200) and the need for diversity based on established clinical classifications (Lekholm & Zarb, Misch).
- The proposal correctly identifies clinically relevant quantitative measures for evaluation, such as distances from the alveolar crest to the nasal floor and IAN canal.

Weaknesses

- The proposal uses vague and non-standard technical terms (e.g., 'poisonous noise', 'self training algorithm') without justification or explanation, raising concerns about the team's technical expertise.
- There is a critical lack of detail regarding the specific AI models to be used. The proposal fails to name any algorithms for image segmentation, bone quality classification, or, most importantly, the automated report generation.
- The methodology for the core objective—automated report generation—is almost entirely absent. It is unclear if a template-based, rule-based, or generative AI (NLG) approach is planned.
- The evaluation plan is superficial. It mentions using validation sets but fails to specify any quantitative performance metrics (e.g., Dice score for segmentation, BLEU/ROUGE for text generation, or clinical accuracy).
- The 'User study' mentioned in the title of Phase-3 is not described at all, leaving a major gap in the clinical validation strategy.
- The methodology completely omits any discussion of ethical considerations, such as institutional review board (IRB) approval, patient consent, and data anonymization, which are mandatory for research involving patient data.
- No limitations, potential risks, or contingency plans are identified. This suggests a lack of critical foresight and planning.
- Phase-4, 'Dissemination and Reporting', is a project management task, not a part of the research methodology. Its inclusion dilutes the focus on the scientific approach.

! Recommendations

- → Replace vague terms with precise, standard terminology. For pre-processing, specify the exact filtering or reconstruction algorithms to be used for artifact and noise reduction.
- → For Phase-2, explicitly state and justify the choice of segmentation model (e.g., U-Net, nnU-Net, Transformer-based architectures). Justify why a 'self-training algorithm' is superior to well-established supervised methods.
- → Provide a detailed plan for the 'Automated Report Generation' component. Specify the architecture (e.g., Transformer-based NLG model, template-filling system) and describe how structured data from the image analysis will be converted into coherent, clinically relevant text.
- → Develop a comprehensive evaluation protocol. Define specific metrics for each task: segmentation (e.g., Dice, IoU), landmark localization (e.g., Mean

Radial Error), classification (e.g., Accuracy, F1-score), and text generation (e.g., ROUGE, BLEU, and expert clinical review).

- → Elaborate on the user study in Phase-3. Detail the study design, the number and type of clinical experts who will participate, the evaluation criteria they will use, and how the AI's performance will be benchmarked against human experts.
- → Add a dedicated subsection on Ethical Considerations. Describe the plan for obtaining ethical approval, the data anonymization protocol to protect patient privacy in compliance with regulations, and the data security and storage plan.
- → Incorporate a 'Limitations and Mitigation Strategies' section. Identify potential challenges (e.g., data scarcity, model underperformance, poor generalizability) and propose specific, credible contingency plans for each.

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Budget Justification

Score: 3.0/10

Section Content

Version 1

S.No. Position Consolidated emolument

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Summary

The budget justification is severely deficient, characterized by a profound lack of detail, questionable cost estimations, and the critical omission of essential resources. While the budget follows a standard structure, the justifications provided are generic and fail to instill confidence in the project's planning and financial management. Key costs, such as dataset acquisition and software, are presented with arbitrary figures and no clear rationale. The complete absence of a budget for required computational hardware (e.g., GPUs) is a fatal flaw that questions the entire project's feasibility. The proposal fails to demonstrate careful planning or value-for-money, making it a high-risk investment in its current form. The evaluation is further hampered by the unavailability of the Methodology and Timeline sections, as a budget cannot be properly assessed in a vacuum.

Strengths

- The budget is presented in a structured, tabular format, which provides a basic level of clarity on the categories of expenditure.
- The calculation for the Junior Research Fellow (JRF) emoluments appears to follow the specified monthly rates correctly.
- The proposal correctly identifies key cost categories such as personnel, consumables, travel, and contingency, which is a standard practice.
- The justification rightly suggests prioritizing open-source tools to reduce software costs, which is a good principle for cost-effectiveness.

Weaknesses

- **Critical Omission of Computational Resources:** The budget lists 'NIL' for equipment. An AI project involving 3D CBCT scans is computationally intensive and requires high-performance GPUs. The failure to budget for or explain how access to such resources will be secured is a critical oversight that undermines the project's technical feasibility.
- **Vague and Inadequate Dataset Justification:** The justification for 'Dental CBCT dataset acquisition' (Rs. 1,00,000) is non-committal ('Either purchase, license, or collect'). These are three vastly different scenarios with different costs and logistical requirements. The budget provides no breakdown of cost-per-scan, number of scans, or costs for ethical clearance and expert annotation, which are substantial hidden costs.
- **Unjustified Software Costs:** The software budget (Rs. 1,00,000) lacks specificity. It vaguely mentions MATLAB and 3D Slicer plugins without itemizing which specific paid tools are necessary and why open-source alternatives are insufficient. The declining cost over three years is also unexplained.
- **Generic Travel Budget:** A significant travel budget of Rs. 3,00,000 is justified with a single generic phrase ('For dissemination and knowledge exchange'). There is no breakdown of costs or a clear plan detailing the number of conferences, locations (national/international), or attendees.
- **Arithmetic and Compliance Issues:** There is a clear arithmetic error in the 'Other Items' table, where the total for Contingency is listed as Rs. 1,00,000 but the sum of the yearly amounts is Rs. 1,50,000. Additionally, the 8% HRA for the JRF is unusually low for most Indian cities and may not comply with prevailing government norms, requiring specific justification based on the institute's location.
- **Underestimation of Resources:** The budget for data storage (Rs. 10,000 for one HDD/SSD) is likely insufficient for a multi-year AI project dealing with large 3D medical imaging datasets.
- **Lack of Alignment:** Without the methodology and timeline, it is impossible to assess alignment. However, the budget's internal logic is weak (e.g., declining data acquisition costs), suggesting a probable misalignment with project activities.

Recommendations

- **Computational Resources:** Immediately address the equipment gap. Either a) budget for a high-performance workstation with specific, justified GPU models or b) provide a formal letter of commitment from the host institution guaranteeing dedicated access to specified HPC/GPU cluster resources for the project's duration.
- **Dataset Plan:** Revise the dataset section completely. Provide a detailed, single plan. If collecting data, detail the process, including costs for ethics approval, patient compensation (if any), and most importantly, the cost of expert annotation by qualified radiologists/dentists. If purchasing, identify the source and provide a formal quotation.
- **Software Itemization:** Itemize all required software licenses. For each, provide the cost, justify why it is essential, and explain why a free, open-source alternative cannot be used. For example, if MATLAB is essential, specify the required toolboxes and provide a quote.
- **Detailed Travel Plan:** Justify the travel budget with a specific dissemination plan. Name potential target conferences (e.g., 'one international conference like MICCAI and one national conference like an ISI symposium per year'). Provide an estimated cost breakdown per trip (registration, airfare, accommodation, per diem).
- **Correct and Verify Calculations:** Proofread the entire budget to eliminate errors. Correct the contingency total. Verify the applicable HRA percentage for the JRF based on the host institution's city classification and cite the relevant government order (e.g., from DST/SERB).
- **Justify All Quantities:** For every item, from storage capacity to number of software licenses, the quantity must be directly linked to the needs described in the methodology. For instance, 'A dataset of 500 CBCT scans, each ~500MB, requires a minimum of 250GB storage. We budget for a 4TB drive to allow for data augmentation, model checkpoints, and future expansion.'

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Team Expertise

Score: 2.5/10

Section Content

Version 1

Principal Investigator : Prof. (Dr.) Gurpreet Singh

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Summary

The team expertise section, focusing on the Principal Investigator's (PI) credentials, presents a mixed picture. While there is evidence of publications and patents, the relevance to the specific proposal topic of AI-based automated report generation from CBCT scans for tooth implantation is questionable. The publications touch on image captioning, script identification, emotion detection, and plant disease detection, but lack a clear and direct connection to the proposed research area. The patents are even further removed. Without a clear demonstration of expertise in the intersection of AI, medical imaging (specifically CBCT), and dental applications, the proposal raises concerns about the team's ability to successfully execute the project.

Strengths

- The PI has a publication record, indicating research experience.
- The PI has patents, suggesting an understanding of intellectual property and innovation.

Weaknesses

- The listed publications and patents lack direct relevance to the proposed research area of AI-based automated report generation from CBCT scans for tooth implantation.

- There is no clear articulation of how the PI's prior experience translates into the specific skills and knowledge required for this project.
- The section only presents the PI's credentials; the expertise of other team members (if any) is not mentioned. This may impact the feasibility of the project given its interdisciplinary nature.
- No information is provided on the role of the PI in the listed publications and patents. This makes it difficult to assess the PI's specific contribution and expertise.
- The listed publications vary greatly in topic, raising questions about the PI's focused expertise in a particular area.

Recommendations

- → The proposal should explicitly address how the PI's prior research experience is relevant to the proposed project. This should include a detailed explanation of the transferable skills and knowledge.
- → If other team members are involved, their expertise and roles should be clearly outlined, focusing on their contributions to AI, medical imaging, and/or dentistry.
- → Include a statement detailing the PI's specific contributions to each cited publication and patent.
- → If the PI has relevant experience not reflected in the publications (e.g., software development skills, clinical collaborations), this should be explicitly stated.
- → Consider including letters of support from collaborators in dentistry or medical imaging to further demonstrate the feasibility and support for the proposed research.

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Expected Outcomes

Score: 4.0/10

Section Content

Version 1

The outcomes of this project are expected to the auto generated medical

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Summary

This section outlines a series of relevant but poorly defined outcomes. While the overarching goal of an automated reporting system from CBCT scans is significant and clinically relevant, the specific outcomes are described with a critical lack of detail, specificity, and measurability. The language is informal and contains technical inaccuracies (e.g., 'poisonous noise'), which undermines the proposal's credibility. The claims of novelty for algorithms and approaches are entirely unsubstantiated, and the inclusion of 'high impact publications' as a scientific outcome is a notable weakness, suggesting a misunderstanding of how to frame research goals. Without clear performance metrics or targets, it is impossible for a reviewer to assess the project's ambition, feasibility, or ultimate success. The outcomes, as presented, fail to provide confidence that the project is built on a rigorous and well-conceived plan. The proposal requires substantial revision to articulate a clear, measurable, and compelling set of outcomes worthy of investment from the Anusandhan National Research Foundation (ANRF).

Strengths

- The proposal correctly identifies the key stages of a potential automated workflow (pre-processing, segmentation, assessment, report generation), indicating a basic understanding of the problem domain.
- The overall aim of automating report generation from CBCT for implant planning is clinically relevant and aligns with the broader trend of AI in medical diagnostics, which is of interest to funding bodies.

Weaknesses

- Extreme Lack of Specificity: Terms like 'new pre-processing algorithms' and 'new approach to automate' are used without providing any detail on the nature of the innovation or the methods to be employed. This makes the claims impossible to evaluate.
- Absence of Measurable Metrics: The proposal fails to define any quantitative or qualitative metrics to evaluate the success of the outcomes. There is no mention of Dice score for segmentation, accuracy metrics for report generation, or Signal-to-Noise Ratio (SNR) improvement for pre-processing.
- Informal and Imprecise Language: The section contains grammatical errors and technically ambiguous terms (e.g., 'poisonous noise' instead of the likely 'Poisson noise', 'a kind of idea'), which detracts from its professionalism and scientific credibility.
- Unsubstantiated Claims of Novelty: The proposal repeatedly claims innovation but provides no evidence or context to differentiate the proposed work from the state-of-the-art. This is a significant flaw in a competitive research proposal.
- Inappropriate Framing of Outcomes: Listing 'High Impact research publications' as a primary outcome is a common mistake. Publications are a dissemination output, not a direct scientific or technical outcome of the research itself. This suggests a weak understanding of grant proposal structure.
- Vague Broader Impact: The potential benefit to clinicians is mentioned vaguely ('provide a kind of idea') but is not developed into a concrete impact statement concerning efficiency, diagnostic accuracy, or patient outcomes.

Recommendations

→ Rephrase each outcome to be specific and measurable using the SMART (Specific, Measurable, Achievable, Relevant, Time-bound) framework. For example, instead of 'New approach to automate segmentation', specify: 'A novel 3D U-Net based segmentation model achieving a Dice Similarity Coefficient of >0.95 for mandible and teeth, benchmarked against expert manual segmentations on a proprietary dataset of 200 CBCT scans.'

→ For each technical outcome (pre-processing, segmentation, assessment), define the exact performance metrics that will be used for evaluation and

state the target values you aim to achieve against a clearly defined baseline or state-of-the-art method.

- → Clearly articulate the proposed innovation. For 'new algorithms', explain *what* makes them new—is it a novel architecture, a hybrid approach, or a new loss function? Provide a brief justification for why this new approach is needed and expected to outperform existing methods.
- → Structure the final outcome, the 'automated medical report', with precision. Detail what specific clinical parameters the report will contain (e.g., bone volume in mm^3, bone density in HU, distance to critical structures like the inferior alveolar nerve in mm). Define how the report's accuracy will be validated (e.g., through a blind comparison study with reports from senior radiologists).
- → Remove 'High Impact research publications' from the list of primary outcomes. Instead, create a separate 'Dissemination and Impact Plan' section where you can detail your publication strategy, plans for open-sourcing code/datasets, or potential for clinical translation and commercialization.
- → Proofread the section carefully to correct grammatical errors and replace informal language with precise, scientific terminology to enhance the proposal's professional standing.

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Risk & Mitigation

Score: 2.5/10

Section Content

Version 1

Environmental impact assessment and risk analysis.

Show More

Summary

The Risk & Mitigation section is weak and superficial. The 'Environmental Impact Assessment' section lacks substance and reads as generic statements with little direct relevance to the project. The 'Risk Analysis' identifies a few relevant risks, but the mitigation strategies are high-level and lack specific, actionable details. The section doesn't adequately address potential risks related to model bias, regulatory hurdles, or the explainability of the AI system's outputs. Overall, the section demonstrates a lack of thorough risk assessment and mitigation planning.

Strengths

- Identifies data privacy and compliance as a potential risk.
- Recognizes the potential for delays in clinical partnerships.
- Acknowledges model reliability as a potential issue.

Weaknesses

- The 'Environmental Impact Assessment' is superficial and irrelevant to the core project activities.
- Mitigation strategies are vague and lack concrete details (e.g., 'secure storage protocols' is not specific).
- Fails to address crucial risks, such as those related to model bias, regulatory approval pathways (if required for clinical use), lack of model explainability,

computational resource limitations, or data availability after initial collection.

- Lacks quantification of risks (likelihood and impact).
- There is no discussion of a contingency plan in case mitigation strategies fail.

Recommendations

- → Replace the 'Environmental Impact Assessment' with a more relevant discussion of ethical considerations in AI development and deployment, such as bias in the training data and potential impact on clinical decision-making.
- → Provide specific details about the 'secure storage protocols' that will be implemented to address data privacy risks, referencing relevant regulations and standards (e.g., GDPR, HIPAA).
- → Elaborate on the strategies for securing early-stage MoUs with clinical partners, including timelines and responsible parties.
- → Provide more detail on how 'diverse data across patient types' will be collected and used to mitigate model bias. Include specific demographic and clinical variables to be considered.
- → Describe the 'rigorous model validation strategies' in more detail, including specific metrics that will be used to assess model performance and fairness.
- → Add a comprehensive risk assessment table that includes a description of each risk, its likelihood, its potential impact, the proposed mitigation strategy, and a contingency plan.
- → Address the risk of regulatory hurdles if the system is intended for clinical use. Detail the steps to be taken to ensure compliance with relevant regulations.
- → Consider the risks associated with maintaining data security and access in the long term.
- → Add discussion of how to address the potential for the model to become outdated or less accurate over time due to changes in clinical practice or CBCT technology.
- → Include a section on data security and access control measures.

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Project Timeline

Score: 2.0/10

Section Content

Version 1

Phase-1: Data Acquisition Q1-Q4 Q1-Q2 Q1-Q2

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Summary

The provided Project Timeline is severely deficient and does not meet the standards expected for a competitive research proposal. While it identifies high-level project phases, it lacks the necessary detail, structure, and logical coherence to be considered a viable project plan. The timeline is presented in an ambiguous format and contains significant logical flaws in the sequencing and duration of activities. This raises serious concerns about the project's feasibility, the team's project management capabilities, and the potential for successful execution. In its current state, the timeline fails to provide the funding agency with the confidence that the project is well-planned and that resources would be managed effectively.

Strengths

- The timeline correctly identifies the essential high-level phases of an AI development project: Data Acquisition, Model Development, Evaluation, and Dissemination.
- The proposal attempts to map these phases across a multi-year project duration, indicating a basic understanding of the project's long-term nature.

Weaknesses

- **Lack of Granularity and Clarity:** The timeline is presented as a high-level list of phases with no breakdown into specific tasks, work packages,

milestones, or deliverables. It is impossible to track progress or understand what will be achieved at any given point.

- **Questionable Feasibility and Durations:** The allocation of 2.5 years for 'Data Acquisition' and 2 years for 'User study and Evaluation' within a 3-year project appears disproportionate and is not justified. Conversely, the critical phase of 'Model Development' may be constrained.
- **Illogical Sequencing:** There are critical flaws in the dependencies. 'Model Development' begins (Y1Q3) long before a substantial dataset could plausibly be acquired (Phase 1 runs until Y3Q2). This suggests a fundamental lack of a coherent plan for iterative development.
- **Absence of Critical Activities:** The timeline omits crucial project stages such as requirements engineering, system architecture design, UI/UX development for the reporting system, and planning for potential regulatory pathways (e.g., CDSCO approval), which are essential for a 'system' intended for clinical application support.
- **No Indication of Risk Management:** The linear and simplistic representation fails to account for potential risks, delays, or scientific challenges. There is no evidence of buffer time, contingency planning, or alternative pathways if a phase is delayed.
- **Poor Alignment and Integration:** Due to the lack of detail, it is impossible to assess alignment with the project's specific objectives and methodology. The timeline should be a direct translation of the work plan, but here it appears disconnected and abstract.
- **Ambiguous Presentation:** The format is unprofessional and difficult to interpret without clear labels for years or a standard Gantt chart structure.

Recommendations

→ **Adopt a Standard Format:** Re-structure the timeline as a detailed Gantt chart. This should clearly label years and quarters and visually represent tasks, durations, dependencies, and milestones.

→ **Introduce Granularity:** Decompose each phase into specific Work Packages (WPs) and tasks. For example, 'Data Acquisition' should be broken down into 'Ethics Approval', 'Data Sharing Agreements', 'Data Collection Protocol Design', 'Data Anonymization', etc.

→ **Define Milestones and Deliverables:** For each major task or phase, specify a concrete deliverable (e.g., 'Curated and annotated dataset of 500 CBCT scans', 'Validated prototype of segmentation model') and a

corresponding milestone (e.g., 'M6: Completion of pilot data collection'). This is critical for progress monitoring.

- → **Justify Timeline and Dependencies:** Provide a clear rationale for the duration of each phase and the overlap between them. If model development is to start early, specify that it will use a smaller, pilot dataset and explain the iterative strategy.
- → **Incorporate All Project Activities:** Add tasks for system-level work, including requirements analysis, software development for the report generation interface, integration, and testing. If clinical use is an eventual goal, include a work package for navigating the regulatory landscape.
- → **Integrate Risk Management:** Build buffer periods into the schedule for high-risk tasks (e.g., data acquisition, model training). Alternatively, provide a separate risk management table that links potential risks to the timeline and outlines mitigation strategies.
- → **Ensure Clear Alignment:** Explicitly link the timeline activities back to the specific project objectives outlined earlier in the proposal to demonstrate a cohesive and well-integrated plan.

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