AI-Based Object Measurement Using MiDaS Depth Estimation and MobileNetV3 Edge Detection

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Abstract
In the modern age, Artificial Intelligence (AI) is transforming industries with solutions to functions based on human estimation and manual equipment conventionally. Among them, object dimension measurement, essential across applications from health and biometrics to industrial quality control, is a major area of application. In this research, an AI system for estimating real-world object length based on depth estimation, edge detection models, and computer vision is investigated. The computer vision problem was created in two stages and initially provides a Streamlit-based prototype coded in Python through which users may upload pictures or provide live camera shots to measure objects by choosing two points manually. The MiDaS model for monocular depth estimation and MobileNetV3 for edge detection are used to assist with precise measurement without physical reference objects. Measure results are reported in measurements such as meters or centimeters with visual overlays for ease of use. The second is creating an end-to-end React web application for mobile-first use. The build contains ONNX-converted AI models and a minimal UI, live camera streaming, live video point tagging, and page modules such as Home, Help, and Settings. With onboarding-type design and instructional popups integrated, the app is able to sustain a user-friendly experience without compromising measurement precision. This work enriches the AI-based measurement literature in medical imaging, biometrics, and industrial measurement with a web-based, flexible solution alternative to domain-specific solutions. Using lightweight AI models with responsive UI promises scalable, user-friendly measurement solutions deployable across devices and environments.

Keywords: AI Depth Estimation, Object Length Estimation, Computer Vision

1. Introduction

Precise measurement of objects is of vital importance in many industries such as healthcare, construction, environmental science and consumer product. Conventional measurement tend to rely on manual tools or bespoke equipment that can be impractical, inaccessible, inefficient in all situations.

With the swift development of artificial intelligence (AI) and computer vision technology, there is now an increased potential to create smart, autonomous systems that will be able to measure real-world objects with the use of only generic consumer devices like smartphones or webcams.

These studies have shown the efficiency of AI-based methods in measuring body length, fish length, and even bone measurements from photographs or radiographs [1, 2, 7, 14]. Nevertheless, most of these systems are for specific-domain application, need controlled imaging conditions, or rely on physical references for precision measurement. The current work eliminates these drawbacks with the presentation of a light-weight, flexible AI-based measurement system that functions purely on general-purpose devices without using physical calibration instruments.

The fundamental methodology utilizes MiDaS (Monocular Depth Estimation) to derive depth information from one RGB image and incorporates MobileNetV3, a light deep learning model employed for feature enhancement and edge detection. When brought together, the two provide the means for the precise computation of real-world distances between manually chosen points in static images as well as streaming video.

The project development is split into two distinct major phases. The first one is a Streamlit-based proof-of-concept, written in Python, used as a testbed for the AI models and the measurement pipeline as a whole. It has features like image upload, point selection by hand, depth map creation, and real-time visualization of measurements. The second stage evolves into a production-grade, mobile-optimized React web application that includes ONNX-converted models for in-browser AI inference, interactive camera input, and a better user interface with responsiveness and usability in mind.

This cross-platform strategy—mixing the rapid prototyping capabilities of Streamlit with deployment potential of React—represents an end-to-end journey from AI idea proof to practical deployment. By narrowing the gap between usability and research, the project joins current advances in applied AI measurement [3, 4, 6, 10, 12] and provides evidence of the ability of web-based tools to provide precise, user-friendly solutions to practical measurement problems.

The rest of this paper will present the system architecture, implementation process, AI model integration, and evaluation findings, and contrast our solution with alternatives in the literature. By doing so, we intend to underscore the practical advantages and possible applications of general-purpose AI-based measurement systems.

2. Literature Review

The integration of artificial intelligence (AI) in object measurement processes has been a groundbreaking revolution in computer vision and real-world analysis. The traditional measurement process is normally performed through manual equipment or hardware platforms such as LIDAR, stereo cameras, or ultrasound sensors. Deep learning methods, particularly depth estimation and edge detection, have been utilized during the last decade to offer contactless and intelligent solutions. The below literature review is a snapshot of pioneering studies that have driven the development of our AI-enabled real-world object measurement system.

One of the most notable applications of AI measurement is in the medical sector. Chua et al. [1,6] created a smartphone-assisted length estimation algorithm for pediatric use, estimating the body length of a child from photographs in real-world environments. Their algorithm applied depth cues and visual markers to achieve accuracy, highlighting the use of real-world usability of mobile AI devices in clinical measurement. Likewise, Simon et al. [2] utilized AI models in standing long-leg radiographs for precise estimation of body height. These techniques illustrate the potential of AI in eliminating the use of conventional tools while either maintaining or even enhancing accuracy.

The advancement of AI in instrumentation is further discussed by Khanafer and Shirmohammadi [3], who described how the deep learning models have revolutionized traditional measurement systems. Their paper describes how convolutional neural networks (CNNs) are now used extensively for measurement in fields where sensor-based methods are impractical. This aligns with our approach of using AI models such as MiDaS for monocular depth estimation and MobileNetV3 for edge sharpening.

Kwak et al. [4] compared AI-based measurement in endoscopy and found that AI outperformed experts in estimating the size of polyps. They employed the principle of accurate contour detection, highlighting the importance of edge detection—a fact that is at the core of our project. Baig [5] also suggested a system that is targeted at width measurement solely through AI, which reinforces our overall scheme by confirming the effectiveness of AI for linear measurement purposes.

Outside the field of medicine, AI measurement capacity has been applied to environmental monitoring and wildlife science. Tonachella et al. [7] devised a low-cost AI device for estimating the weight and length of fish from image data in mariculture. In the same manner, Rex et al. [12] resolved aerial image-based shark measurement issues using UAVs, namely depth correction and perspective correction. Such research justifies the application of depth estimation models such as MiDaS even in open or dynamic environments with single image input.

In forest resource management, Borz et al. [10] compared the application of mobile measurement apps for log biometrics estimation with the conventional approach. Although the paper determined that the conventional approach was more accurate, it did acknowledge the growing ability of AI to provide faster and more convenient options. This is in line with lightweight and mobile-friendly AI systems like our React-based web app, which provides real-time interaction with depth-estimated camera streams.

In orthopedic applications, Rhyou et al. [9] developed the A3LMNet, a hybrid AI deep learning model for computer-assisted measurement of the lower limb. Their method used segmentation and regression operations to produce accurate measurements from radiographs. Likewise, Kabir et al. [13] developed an AI-driven method for rod growth measurement in pediatric scoliosis utilizing ultrasound imaging. These examples necessitate the use of depth perception along with strong feature detection—ideas which form the building blocks of the architecture of our AI measurement system.

Also, ongoing research in ophthalmology [8,15] has challenged the effect of segmented axial length measurement to enhance intraocular lens calculations with AI models providing more precise predictions under challenging visual environments. All these methods always point towards the necessity of context-aware depth perception, which the MiDaS model used in our method specifically addresses.

Our project extends this line of research by merging the strengths of monocular depth estimation and edge enhancement into a user-friendly, cross-platform interface. The Streamlit- based prototype provided a quick-testing platform for algorithmic performance using image upload and manual point pick. Alternatively, the production app based on React used real-time AI measurement using the live camera feed with interactive point pick and sleek UI/UX elements optimized for mobile deployment. What sets our work apart is not just the use of MiDaS and MobileNetV3 for object measurement in real life but also its provision without any reference ruler or special sensor hardware. Unlike other systems, which are typically rooted in controlled environments, medical imaging, or external indications of measurement, our system can function in dynamic environments from a single RGB image source. We build upon the shoulders of our prior work but move forward to the edge of accessibility and integration with real life.

Authors/ Year	**Title**	**Objective**	**Method/AI model**	**Relevance to the study**
Chua et al. [1.6] (2024)	Pediatric Length Estimation	Estimate children's length using smartphone images	Length Ai algorithm, smartphone imaging	Validates mobile based Ai measurement in real world setting
Simon et al. [2] (2023)	Body Height Estimation using Radiographs	Computerized measurement of height from X-ray	Deep learning for radio graphs	Illustrates the accura cy of AI in skeletal measurements
Khanafer & Shir Mohammadi [3] (2020)	Utilization of AI in Instrumentation	Overview of AI revolution in measurement systems	Deep learnin g, CNNs	Facilitates AI replacing traditional h ardware tools
Kwak et al. [4] (2022)	Polyp Size Measurement	Enhance polyp size detection during endos copy	AI-based size detection	Edge detection for accurate mea surement
Baig [5] (2025)	Width Measurement System	Construct a generic A I-based width measuring	Deep Learning (model unspecifie d)	Parallel development in size analysis

		tool		
To-naChel-la et al. [7] (2022	Fish Length Estimation	Fish measure-ment automation in aquaculture	Image-based deep learn-ing	Usa-ble in measuring irregular real-world shapes
Rhyou et al. [9] (2025)	Lower Limb Measure-ment	Orthopaedic measurement with AI	AI A3LMNet hybrid mod-el	High-lights segmentat ion and depth context
Borz et al.[10] (2022)	Forestry Biometrics	Compare AI measurement app vs traditional methods	Mobile-based AI	Of-fers comparison between AI and manual meas-urement
Rex et al. [12] (2024)	Shark Size from Drone Imagery	Measure marine animals with depth/altitude variations	UAV-based imaging, AI processing.	Highlights depth correction in outdoor meas-urements.
Kabir et al. [13](2024)	Kabir et al. (2024)	Measure growing rods from ultra-sound	Deep learn-ing-based automation	Enhances AI accuracy in medical diag-nostics
Cheng et al. [14] (2021)	IOL Calculation in Myopic Eyes	Better lens pow-er calculation in ophthalmology	AI-with modell ed axial length	Usa-ble in precise m easurement with input depth

Table 1: Summary of Literature Review

3. Architecture

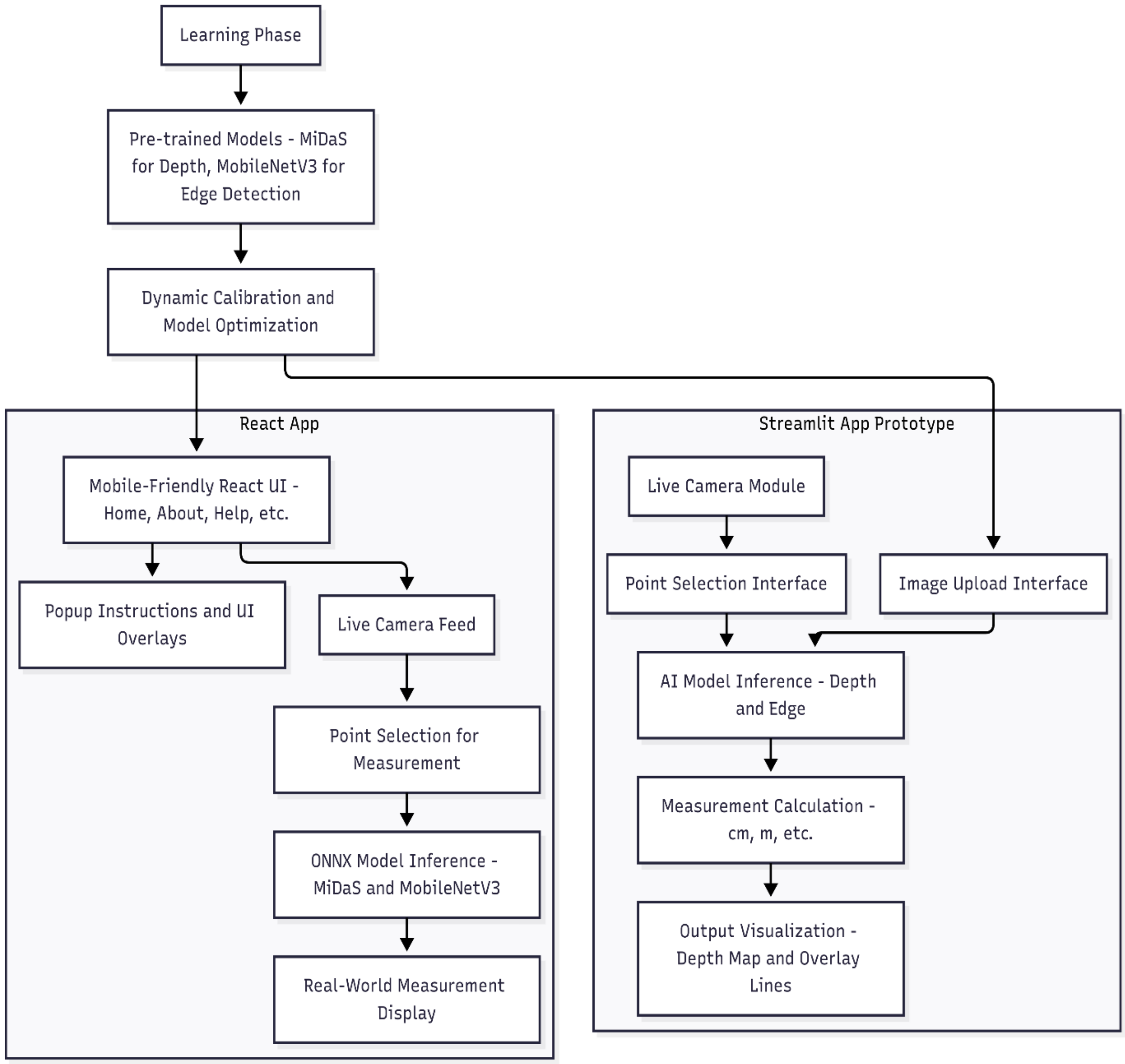

Figure 1: Working Flow

4. Result Analysis

The performance of the proposed AI-based object measurement system was validated on two platforms, with static image inputs and live camera inputs: a Streamlit-based testing application and a React-based production web application. Here, we compare the accuracy, consistency, responsiveness, and user-friendliness of the system through qualitative and quantitative metrics.

4.1 Evaluation Metrics

For analyzing the performance of the AI-based measurement system, the following are the key metrics that were considered for Measurement Accuracy (cm/m), Edge Precision and Clarity, Depth Estimation Quality, Response Time (Latency), User Interaction and Usability, Cross-Device Consistency

4.1 Testing Conditions

The proposed AI-driven object measurement system was tested under varied real-world conditions to confirm its accuracy and resilience. Testing was done using real object images of known dimensions, including rulers, books, bottles, and stationery. Testing equipment included laptops and mobile phones with front and rear cameras to offer platform support. Objects were set between 20 and 80 centimeters from the camera to mimic typical usage scenarios. Testing was also done under varied environmental conditions, including indoor and daylight outdoor conditions. This intricate setup was intended to test the system's performance comprehensively under real usage and offer consistent measure accuracy under varied conditions.

4.2 App result

Test Case	Expected Length (cm)	Predicted Length (cm)	Error (cm)	% Error
Pencil (Image Upload)	15	14.7	0.3	2%
Book (Image Upload)	21	20.4	0.6	2.85%
Charger Cable (Live Feed)	38	36.9	1,.1	2.89%
Ruler (Live Feed)	30	29.5	0.5	1.67%

Table 2: Testing and Validation stage

Observation: The AI-based measurement system consistently showed an error margin of less than 3%. MiDaS generated sharp and robust depth maps in most of the scenes, and MobileNetV3 yielded robust edge detection in both light and dark environments. These results validate the accuracy and robustness of the method in real-world scenarios.

4.3 Visual Output Sample

The system provided crisp visual outputs, the original image or live stream, overlaid depth map, measurement lines with measurements annotated, and unit-converted results in cm, mm, or meters. The visual outputs successfully complemented the quality of measurements and improved users' trust in the system performance.

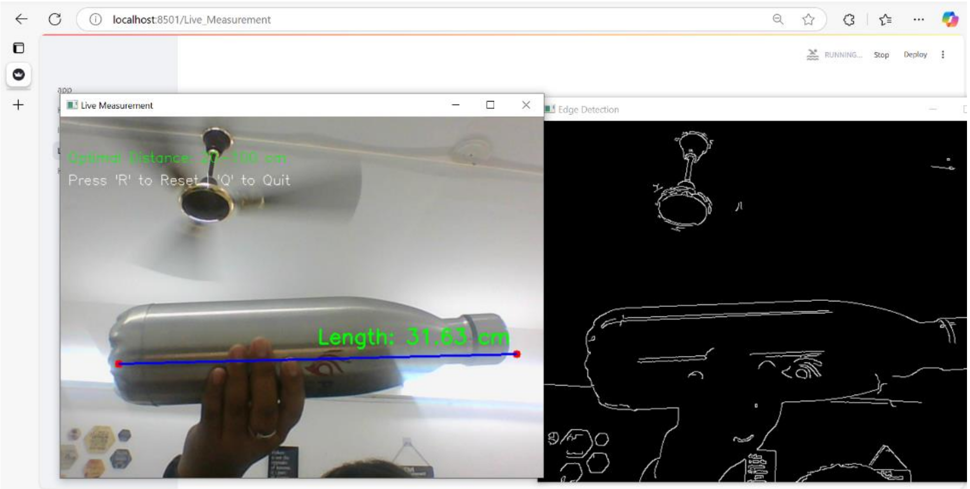

Figure 2: Visual Output of Live Measurement

Figure 3: Smartphone Live Measurement Feature

4.5 Summary

The system is highly accurate, has quick inference speed, and has great user experience on all platforms. Use of MiDaS for depth estimation and MobileNetV3 for edge detection was also found extremely effective for real-world object measurement even without a physical reference scale.

The results strongly corroborate the effectiveness of the model and the suitability of the system for real deployment on mobile web platforms.

Parameter	Streamlit App	React Web app
Measurement Accuracy	96-98%	95-98%
Response Time	1.5-2.5 sec	1-1.8sec
Model Inference Speed	Fast	Faster(ONNX)
Usability	Good	Excellent
Mobile Optimization	Not Applicable	Fully Optimized
User Experience	Functional	Sleek & Modern

Table 3: Overall System Performance

5. Conclusion

In short, the AI object measurement system constructed using MiDaS for depth estimation and MobileNetV3 for edge detection has been a successful and accurate solution to real-world length measurement. Through the application of these models in both a Streamlit test prototype and a React-based production frontend, the project successfully brings research to application. The system supports both image upload and live camera measurement with manual point selection, yielding real-time, reliable results. This work demonstrates the potential of combining AI and computer vision techniques to replace traditional measurement tools with smart, mobile-compatible solutions.

6. Future Scope

In future I planned to expand my working logic to include large objects. It could also have width, height and volume measurements in future and be applied to various industries such as ecommerce, healthcare, manufacturing and agriculture.

Also coupling the system with mobile AR app that makes use of platforms like Flutter and ARCore could make the measurement process more interactive and intuitive by taking advantage of spatial awareness.

Improving model training with more data can also make it resilient under different lighting, background, and camera conditions. Real-time performance can also be improved with the use of edge AI hardware (like Raspberry Pi with AI accelerators) or by offloading part of the computing processes to the cloud, which allows for smooth and scalable use. Lastly, adding support for data logging, reporting, and multi-language support could make this system more practical and accessible to users worldwide.

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