Mobile-Enabled Diabetic Foot Analyzer
A portable screening device for diabetic neuropathy
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Problem/Motivation: Diabetic Neuropathy in India
• India has the largest diabetic population in the world. 25% of diabetics develop a foot ulcer due to neuropathy [1]. Ulcers precede 85% of amputations [2].
• At least half of these ulcers can be prevented by appropriate treatment and patient education [3].
• Current diagnostic equipment is expensive, bulky, and requires trained operators. As a result, rural patients are not being tested for neuropathy.

Existing Diagnostic Tests
• Gold standard is the nerve conduction study.
• Tuning forks and monofilaments are effective but binary.
• Middle ground is vibration perception threshold (VPT) measured with a biothesiometer.

• However, existing biothesiometers are large and heavy, mechanically and electrically inefficient, and inadequately characterized.

![Biothesiometer](image)

<table>
<thead>
<tr>
<th>Reliable</th>
<th>Quantitative</th>
<th>Cost</th>
<th>Portable</th>
</tr>
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<tbody>
<tr>
<td>Nerve conduction</td>
<td>✔ ✔ ✔ ✔</td>
<td>$$$</td>
<td>X</td>
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<tr>
<td>Tuning fork / monofilament</td>
<td>✔</td>
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<tr>
<td>Biothesiometry</td>
<td>✔ ✔</td>
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<td>m-DFA</td>
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Our Solution: Mobile-Enabled Diabetic Foot Analyzer
The Mobile-Enabled Diabetic Foot Analyzer (m-DFA) is designed for operation by community health workers with minimal technical background as part of the Rural NonCommunicable Disease Prevention Program (R-NCDPP) in Tamil Nadu, India.

Initial Prototype
A probe vibrating at 100 Hz is applied to the sole of the foot with a predetermined force. The vibration amplitude is slowly increased until the patient feels the stimulus. The amplitude (in μm) at this point is the VPT.

![Initial Prototype Diagram](image)

Next Steps and Future Work
• Incorporate feedback gathered from field workers during summer visit to India.
• Validate against existing biothesiometers and nerve conduction studies, and determine relationship between VPT amplitude and degree of neuropathy.
• Engineering characterization of device.
• Test in other healthcare settings and locations.
• Design for manufacturing.

References

Acknowledgments
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