



Biodegradable smart footwear that reads your health from every step

Reads every step. Returns to the soil.

Track 06: Bioplastics and Biomaterials

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solum

Reads every step. Returns to the soil.

Shoes are made from oil, glued shut, and thrown away

23.9 bn

pairs of shoes were made worldwide in 2024. India made 12.5% of them, the second largest share.

90%

of discarded shoes end up in landfill or are burned. Only about 5% are recycled.

65

parts can go into one running shoe, nearly all glued together, so it cannot be taken apart.



Smart shoes add batteries and circuit boards to the same pile.

India generated 17.5 lakh tonnes of e-waste in 2023-24 and formally recycled less than half. The cost lands on cities, waste pickers, and the soil and water around dumps.

How you walk is an early health signal that nobody reads

12 years

Walking speed began slowing about 12 years before mild cognitive impairment was diagnosed, in a 20-year ageing study.

Buracchio et al., Archives of Neurology, 2010

4 years

Irregular, uneven steps picked up by a wearable sensor appeared about 4 years before a Parkinson's diagnosis.

Del Din et al., Annals of Neurology, 2019

86%

fewer foot-ulcer recurrences in people with diabetes whose pressure-sensing insoles alerted them, when worn 4.5+ hours a day.

Abbott et al., Lancet Digital Health, 2019

34,000+

older adults across nine studies: their walking speed predicted how long they would live.

Studenski et al., JAMA, 2011

India has 101 million people with diabetes and 149 million aged 60 and over. A wrist band can't see these signals, and a clinic sees them once a year at best. Solum does not diagnose; it spots the change early and says when to get checked.

Your wrist can't feel your feet. Solum can.

	Fitness bands and watches	Smart insoles	Eco sneakers	Clinic gait labs	Solum
Pressure and balance, read at the foot	No	Yes	No	Yes	Yes
Gait quality every day, not once a year	Partly	Yes	No	No	Yes
Knee mechanics for athletes	No	No	No	Yes	Yes
AI coaching on how to walk and train	Yes	Partly	No	No	Yes
Body made to biodegrade, electronics reused	No	No	Partly	Not applicable	Yes

Others measure the wrist or ignore the planet. Solum reads your health from the ground up, and goes back to the ground when it is worn out.

One core, three products, one app

Each product has a biodegradable body and the same removable sensor core. The core moves into your next pair, and the app turns every step into health insight.



Solum Shoe

₹9,999

Everyday walkers and runners

Senses: Pressure film and motion sensor

Tells you: Walking speed, step rhythm, balance and foot strike



Solum Slide

₹5,999

Older adults at home

Senses: Pressure film, heat map first

Tells you: Steadiness, pressure hotspots and walking-speed trend



Solum Knee

₹6,999

Athletes and knee rehab

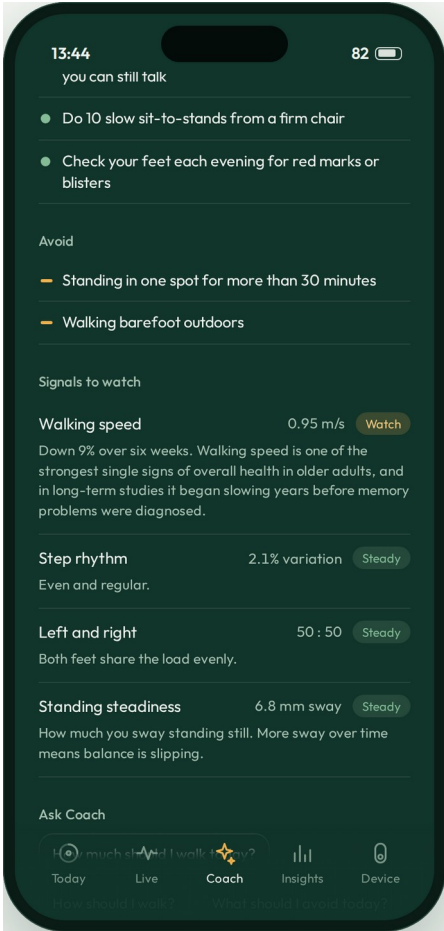
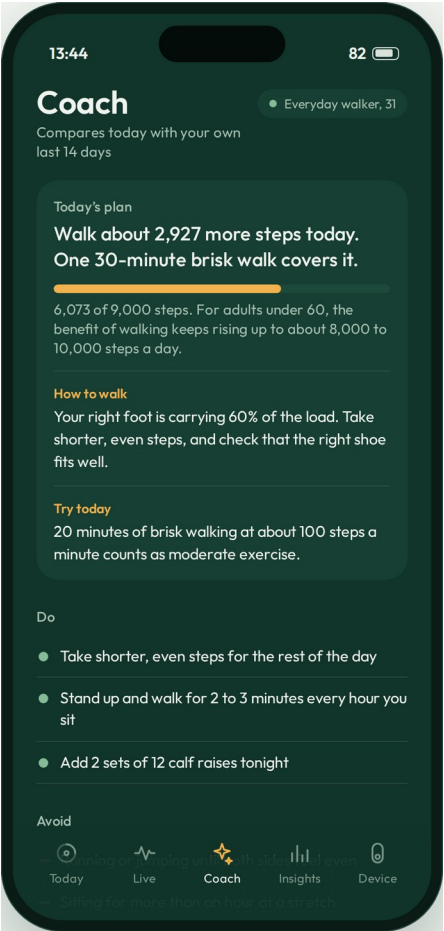
Senses: Bend sensor and motion sensor, worn with Solum Shoes

Tells you: Knee bend range, landing load and left-right load

Seven signals, and what each one can warn you about

Signal	What it is	What it can flag	From
Walking speed	How fast you walk on an ordinary day	Overall health and frailty. In studies it slowed years before memory problems were diagnosed.	Shoe, Slide
Step rhythm	How regular each step is	Balance problems. Rising variability appeared years before Parkinson's in one study.	Shoe, Slide
Left-right balance	How evenly your feet share the load	Injury, recovery after a stroke or surgery, overuse.	All three
Pressure map	Where pressure peaks under each foot, and for how long	Diabetic foot-ulcer risk, foot pain, poorly fitting shoes.	Shoe, Slide
Standing steadiness	How much you sway standing still	Balance and fall risk, tracked over weeks.	Slide, Shoe
Steps and cadence	How much, and how briskly, you walk	Daily targets. Health benefit keeps rising up to 6,000 to 10,000 steps, depending on age.	All three
Knee bend and landing load	How far the knee bends, and how hard you land	Knee strain and ligament injury risk, rehab progress.	Knee

The coach tells you what to do next, in plain words



How much to walk

"Walk about 2,900 more steps today. One 30-minute brisk walk covers it."



How to walk

"Your right foot is carrying 60% of the load. Take shorter, even steps."



What to do

"Three rounds of 30-second single-leg balance, holding a chair."



What to avoid

"Skip jump training today. Your landings are harder than your baseline."



When to get checked

"Your walking speed has dropped 9% in six weeks. Worth mentioning at your next check-up."

It compares you with your own baseline, explains every suggestion, and never diagnoses.

What makes Solum different



Health read from the ground up

Pressure, gait and balance measured at the foot, where wrist wearables cannot see.



One core, three bodies

The same sensing core moves between the Shoe, Slide and Knee band, and outlives every shell.



A sole from plants and crop waste

Natural rubber, rice-husk silica and lignin. No oil-based polymer goes into the sole.



A coach that compares you with yourself

Every insight is measured against your own baseline, so small changes show up early.

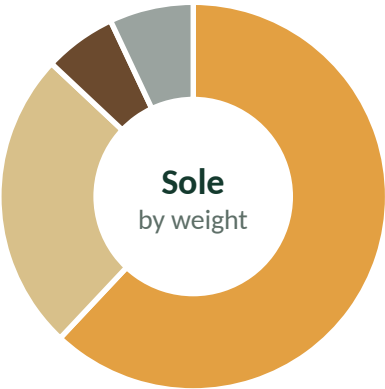


Also: one printed pressure film instead of eight sensors, dock charging with no ports, and a shoe that tracks its own wear.

A sole from a rubber tree, a rice mill and sawdust



Illustrative image of the raw materials.



0%
oil-based polymer in the sole.
One tree gives both the latex
and the sawdust lignin.

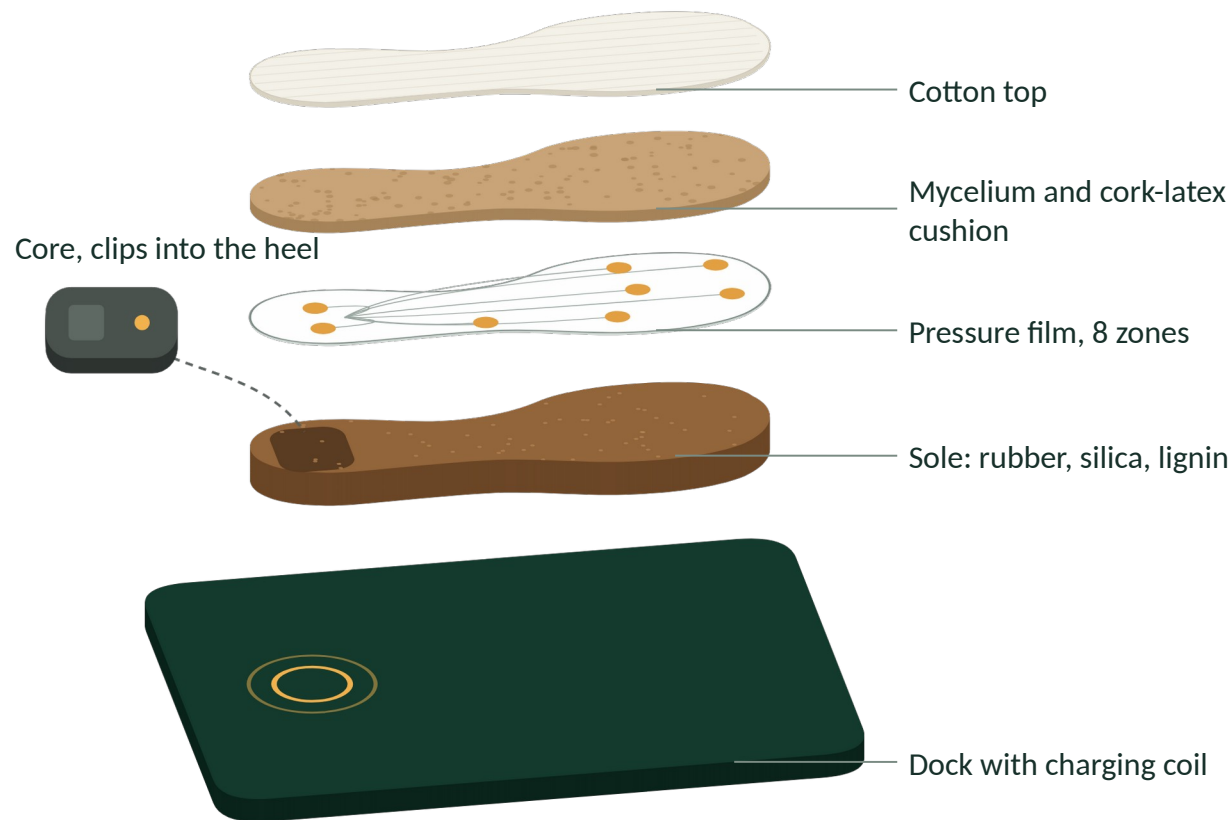
- **Natural rubber, 62%**
Latex tapped from Hevea trees in Kerala. Flexible, waterproof, grips.
- **Rice-husk silica, 25%**
From rice-mill husk ash, which is about 90% silica. Harder wearing, handles heat.
- **Lignin, 6%**
From rubberwood sawdust or paper-mill waste. Blocks UV and slows ageing. Kept near 10 parts per 100 rubber, as more makes the sole stiff.
- **Curing aids, 7%**
A peroxide cure with magnesium oxide, so no sulfur. The only part that is not plant-based.
- **Beeswax finish**
Rubbed on top for extra water resistance.

Insole, top to bottom

- Cotton top fabric
- Mycelium leather, 1-2 mm
- Cork granules and natural latex, 3-5 mm
- Natural rubber base

Upper: organic cotton canvas. Glue: natural latex. Thread: cotton.
Knee band: natural rubber foam in place of neoprene, with an organic cotton knit.

Simple sensors, one small cell, no plugs



Pressure film

One printed sheet under the insole, 8 zones per foot. Builds the heat map. Shoe and Slide.



Motion sensor

Steps, speed, stride and foot strike. In the Shoe and the Knee band.



Bend sensor

A printed strip across the knee measures how far it bends. Knee band only.



Core and dock

Bluetooth, memory and a small sealed cell, cushioned in the heel. Charges on the dock, about a week per charge.

Logs 100 times a second



Stores steps when the phone is away



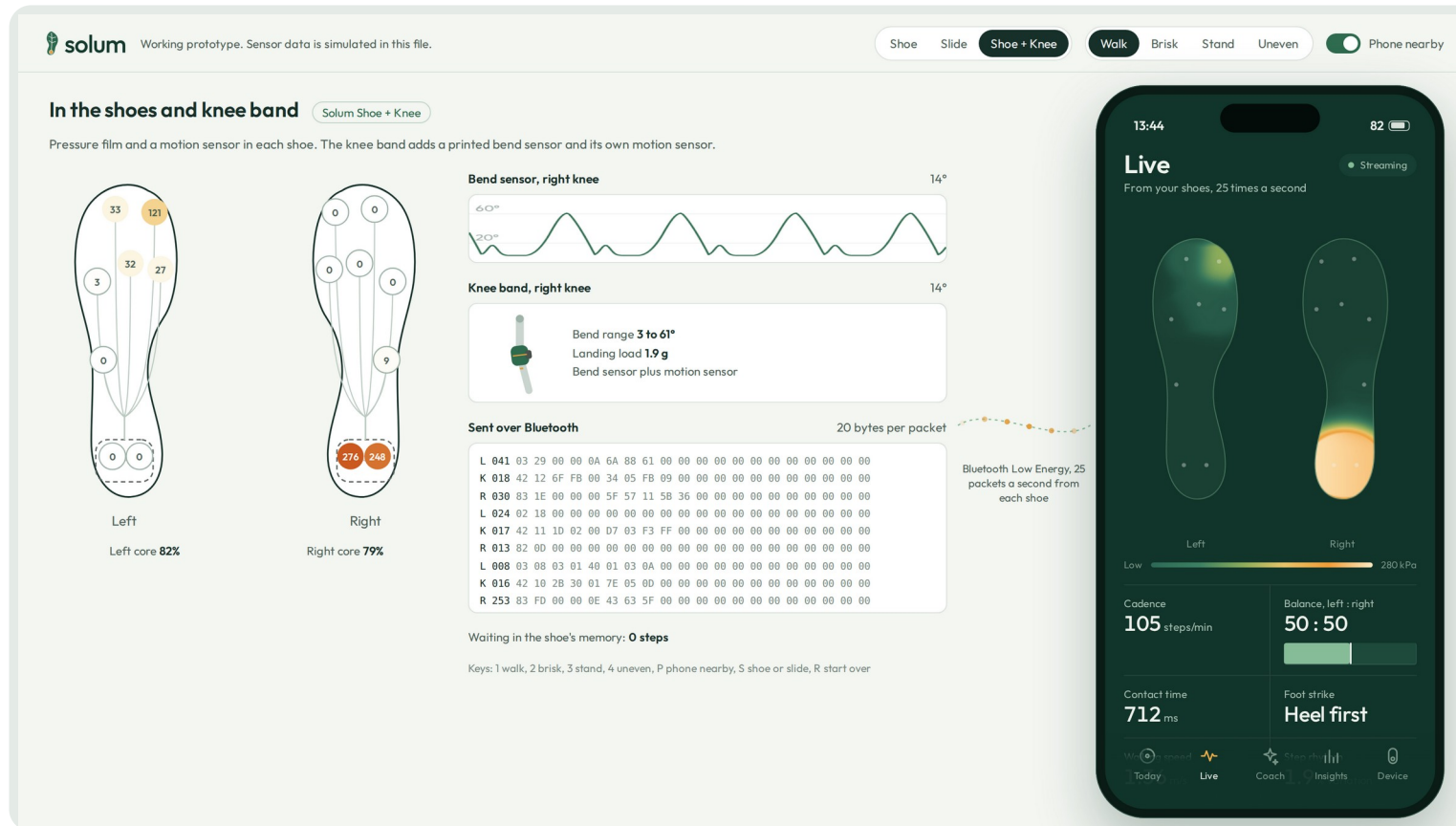
Syncs over Bluetooth Low Energy



Coach compares with your baseline

Left out on purpose: GPS, SOS, fall alarms and lights. Your phone already does those.

A working app prototype, synced to the shoe and knee band



What the live demo shows

- 1 Pairing, then syncing the steps the shoes stored
- 2 Live pressure, walking speed and step rhythm
- 3 Coach: today's plan, do and avoid, signals to watch
- 4 Knee band: live bend angle and landing load
- 5 Phone out of range: the shoe keeps counting, then syncs



Try it on your phone

solumapp.pages.dev

The film and the deck are there too.

Next: three sole recipes, wear tests and a 180-day soil burial.

Runs offline from one HTML file. Sensor data in the demo is simulated; the packet format matches the planned firmware.

What each pair saves, and where it goes after

93%

of the sole by weight comes from plants or crop waste.

~190 g

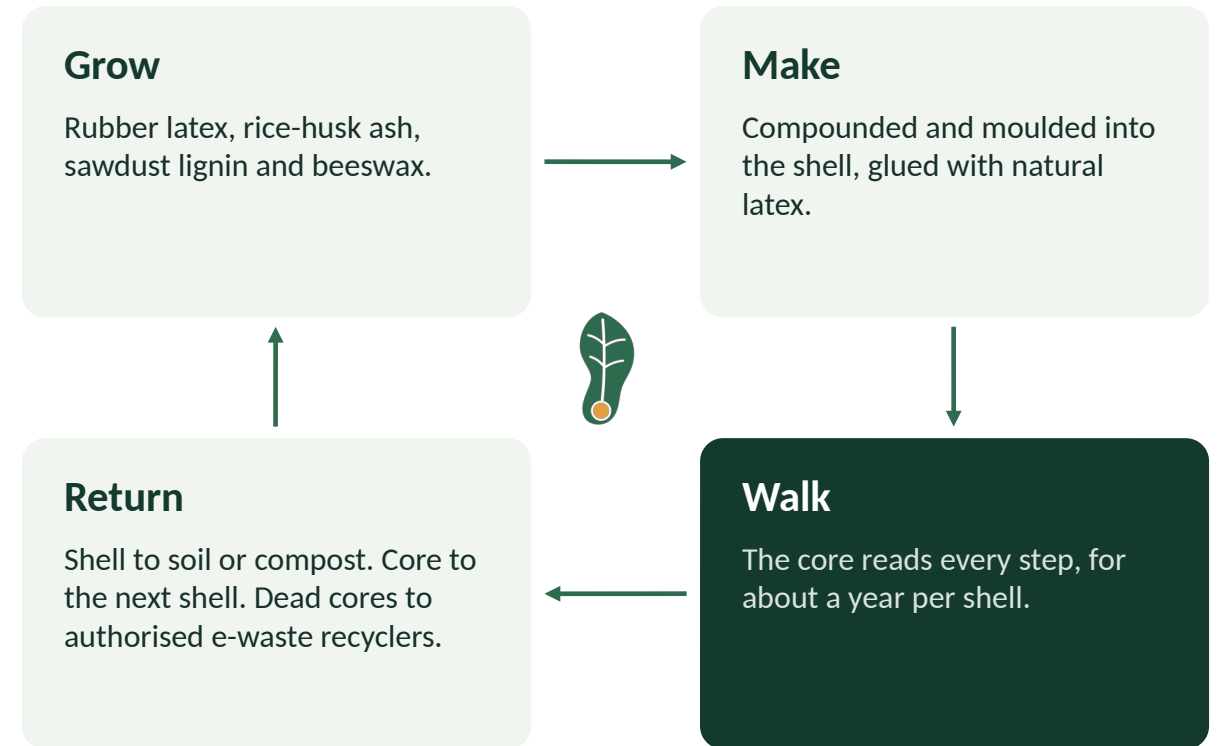
of rice-husk silica and lignin in every pair, made from waste streams.

0

batteries thrown out with any product. The core moves to the next one.

60 t

of synthetic sole material avoided for every 1 lakh pairs sold.



How it breaks down: soil bacteria such as *Streptomyces* and *Gordonia* cut rubber chains with latex-clearing protein, white-rot fungi break down lignin, and soil microbes digest cotton and mycelium. Vulcanised rubber is slower than raw latex, so our first lab test is a 180-day soil burial.

Every pair buys from farmers, mills and beekeepers



Rubber growers

India has over 13 lakh rubber growers, mostly smallholders. Solum is a new, higher-value buyer for their latex.



Rice mills

Husk ash becomes something to sell instead of something to dump. India produces about 24 million tonnes of husk a year.



Beekeepers

Beeswax for the finish, bought from rural and forest beekeepers.



Footwear makers

Made with existing South Indian footwear makers, using rubber moulding skills they already have.



Older adults, people with diabetes and athletes get early, plain-language insight.

India has 149 million people aged 60 and over and 101 million with diabetes. The Slide is priced and designed for older users; the Knee band for sports academies and rehab.

One price, no subscription

Solum Shoe ₹9,999

Walkers and runners aged 20 to 45 who already buy fitness wearables.

Solum Slide ₹5,999

Adults over 60, often bought for them by their children.

Solum Knee ₹6,999

Athletes, sports academies and knee rehab.

Replacement shell ₹1,299 to ₹2,999

Move your core across. No new electronics.

App and Coach Free

Every feature comes with the product.

Revenue

Product sales first, then shell refills about once a year.

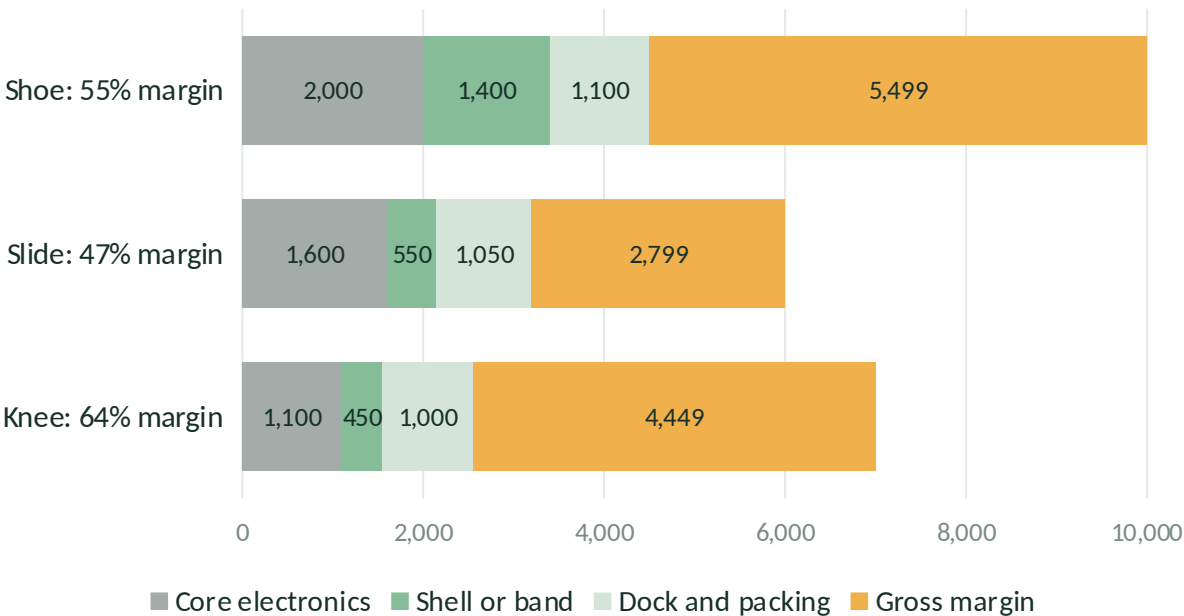
Channels

Own website and marketplaces. Pharmacies for the Slide, academies and physios for the Knee.

Scale

One core across three products. Contract manufacturing in existing footwear clusters.

Estimated cost and margin per unit, in rupees



Costs are estimates at 10,000 units a year, to be confirmed with suppliers. Gross margin is before marketing and returns. Shoe and Slide prices include two cores and a dock.

What could go wrong, and how we handle it

	A sole that breaks down but still lasts	Tune silica and lignin, use a sulfur-free peroxide cure, and test abrasion alongside a 180-day soil burial.
	A battery under the foot	Small sealed cell with a protection circuit, cushioned in the heel, no exposed port. Crush and drop tests first.
	Health claims	Launch as wellness insights, with no diagnosis. Run a clinical study with a hospital before any medical claim, then seek CDSCO approval for specific features.
	Health data privacy	Data stays on the phone unless the user shares it, in line with India's DPDP Act, 2023.
	People forget to charge	Nothing to plug in. Park on the dock overnight; target about a week per charge.

What we need to build it

- A rubber compounding lab: two-roll mill and moulding press
- Electronics prototyping kits
- A hospital partner for a clinical study
- A sports academy for the Knee band trial

The next 12 months



Months 1 to 3

Recipe, core and coach

Mix three sole recipes and start a 180-day soil burial. Core v1 on dev boards; the coach runs on real sensor data.

Months 4 to 6

Shoe and Slide trial

Prototypes with 20 walkers and in 20 homes. Build each person's baseline.

Months 7 to 9

Knee band, recipe lock

Knee band trial with a sports academy. Soil burial results come in; we lock the recipe.

Months 10 to 12

Pilot and clinical study

200-unit pilot batch. Start a clinical study with a hospital on gait and pressure signals.

Support we need

A BIRAC BIG grant, up to ₹50 lakh over 18 months. A rubber compounding lab. A hospital and a sports academy as study partners.



Thank you

Solum reads your health from every step. The shoe returns to the soil, and the core moves to your next pair.

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Scan for the prototype, the film and the deck

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The team

AZ

Arfa Zainab

Lead: biomaterials and research. [Course, year]

SJ

Shreeji Jha

Product, app and data. [Course, year]

UH

Uttara H

Hardware and sensors. [Course, year]

Advisors we want on board: a polymer scientist, a footwear maker, a physiotherapist and a neurologist.