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The visually impaired have formed habits to overcome challenges they face while in transit. They cannot rely on these habits completely, causing them to depend on assistance from others , making them less responisble for their own safety.

RESEARCH PROCESS

SHADOWING AND CAMERA STUDY

06
people observed

Using public transport. At Dadar Train Station (Mumbai)

07
people observed

Navigating through public spaces. At Dadar Phool Gully (Mumbai)

This phase helped observe the behavioral patterns of various visually impaired people as they travelled from one point to another as they do in their daily lives everyday.

EMPATHY INTERVIEWS

06
people interviewed

In joint accomodations. At The Muncherjee Nowrojee Banajee Industrial Home for the Blind (Mumbai).

07
people interviewed

In a blind association. At Relief & Welfare Society For The Blind (Mumbai).

07
people interviewed

In transit. At Dadar Train Station (Mumbai).

This phase helped validate the observations made in the previous phase and understand why certain habits observed were cultivated, along with other challenges phased by the visually impaired to transit safely.

BEHAVIOURAL PATTERNS OBSERVED

Figure 1

Man making sure he is on the side of the road, by rubbing his shoulder against parked cars.

Figure 2

Woman touching the texture on the wall of the station to orient herself.

Figure 3

Man waiting for very long for assistance when lost.

"~~Go straight and take the second left from the circle. I'll meet you at the bus stand in front of the large glass building.~~ What if you don't know which left? If you passed a bus stand? How large is large?

Figure 4

Man carrying a speaker playing loud music in a jhola, in order to alert people to stop as he crosses the road

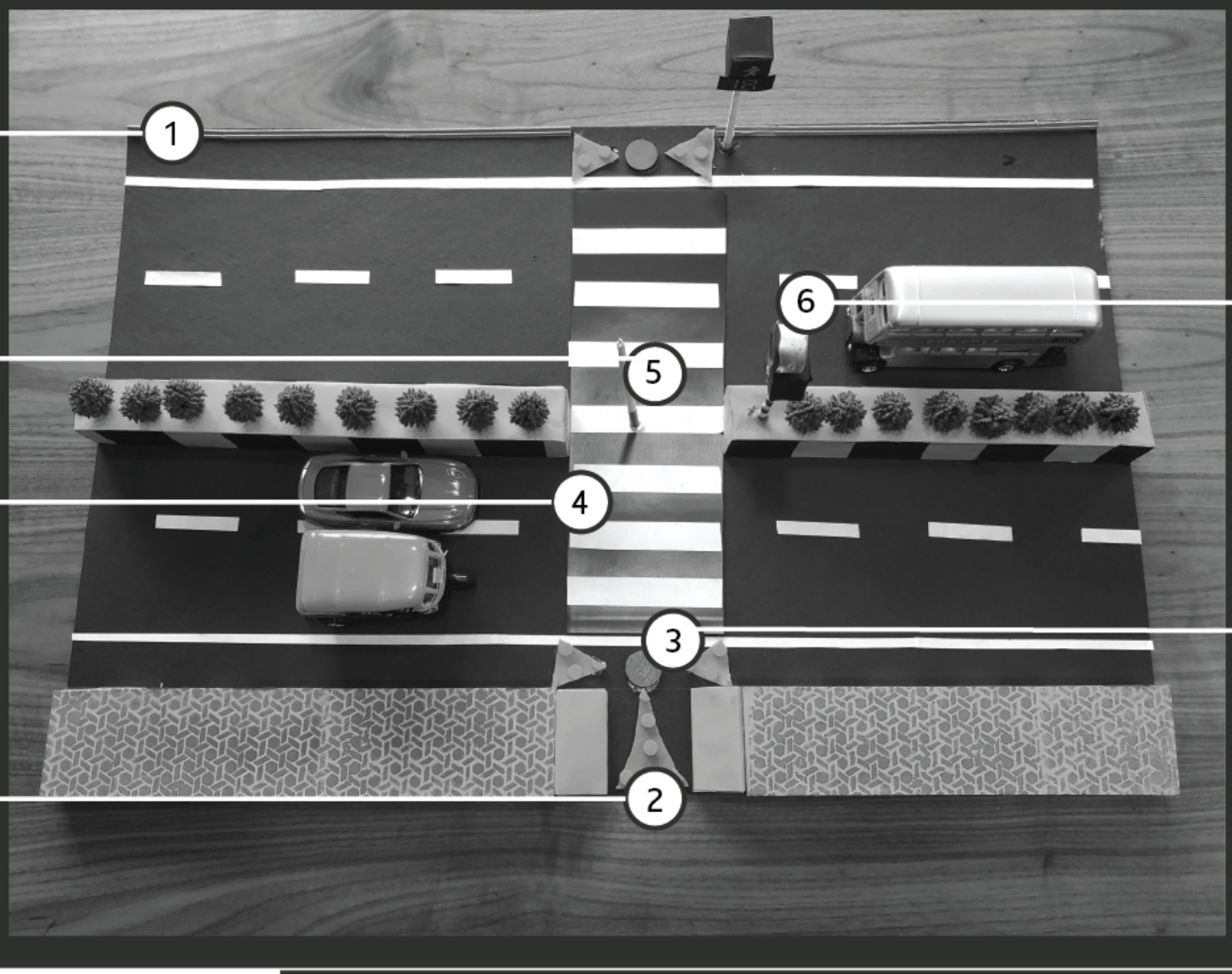
Figure 5

Man extending his hand out hoping somebody would help him cross the road.

Figure 6

Woman Navigating by sensing the texture of the ground, by dragging her stick along the floor.

FINAL CONCEPT



A **continuous tile** for visually impaired to follow **along** using their walking stick, to ensure they are on the side of the road.

A walking stick with a **magnetic** end.

A zebra crossing that turns **magnetic** when the time turns on and it is safe to cross the road.

Tiles that indicate the **direction and position** of the zebra crossing.

A speaker attached to the timer that plays an alarming sound with **increasing number of beeps** to indicate a sense of time for which the zebra crossing would remain active.

A circular electro magnetic tile before the zebra crossing, where the visually impaired could wait. The tile itself turns magnetic with the zebra crossing, so that the visually impaired don't have to extend their sticks out on the busy road to check when it is safe to cross. It also ensures that they walk at the centre of the crossing, to avoid accidents with the cars lined behind it.

USER TESTING

A true scale model of the idea proposed was created as seen in the diagram .

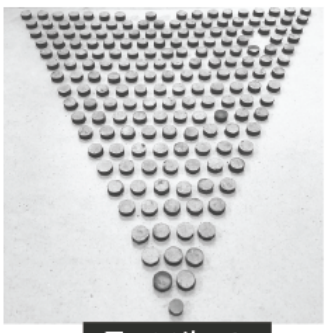
The environment of a busy street was created using sound.

Throughout the user testing, the participants were requested to think out loud, and describe how they felt.

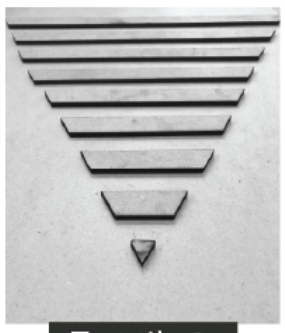
Before user testing, participants were briefed and were provided with a stick with a metallic end.

01 The testing began with checking if the users could follow a curved path using texture on a footpath, without assistance.

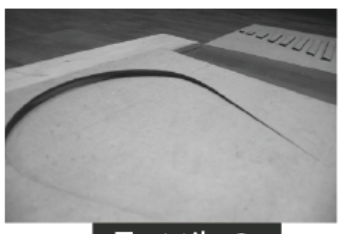
02 Various directional tiles were tested at the bottom of the footpath. The time taken to identify the direction was noted, to understand the learnability of the tile.



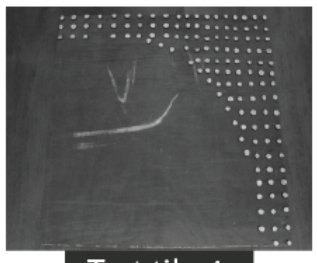
Test tile 1



Test tile 2

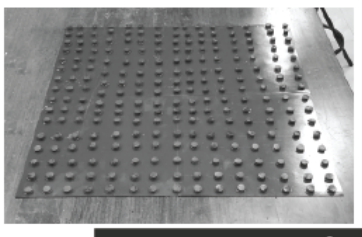


Test tile 3



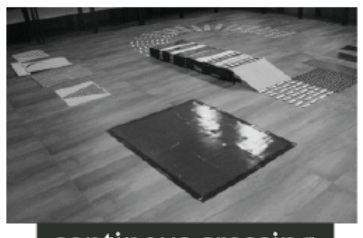
Test tile 4

03 The users were then assisted to test a magnetic tile created to indicate where to wait before crossing a road.



Waiting area for zebra crossing

04 Further, the users tested both, a zebra crossing with a continuous magnetic field, and a non continuous one, to understand which fit their mental model more.



continous crossing

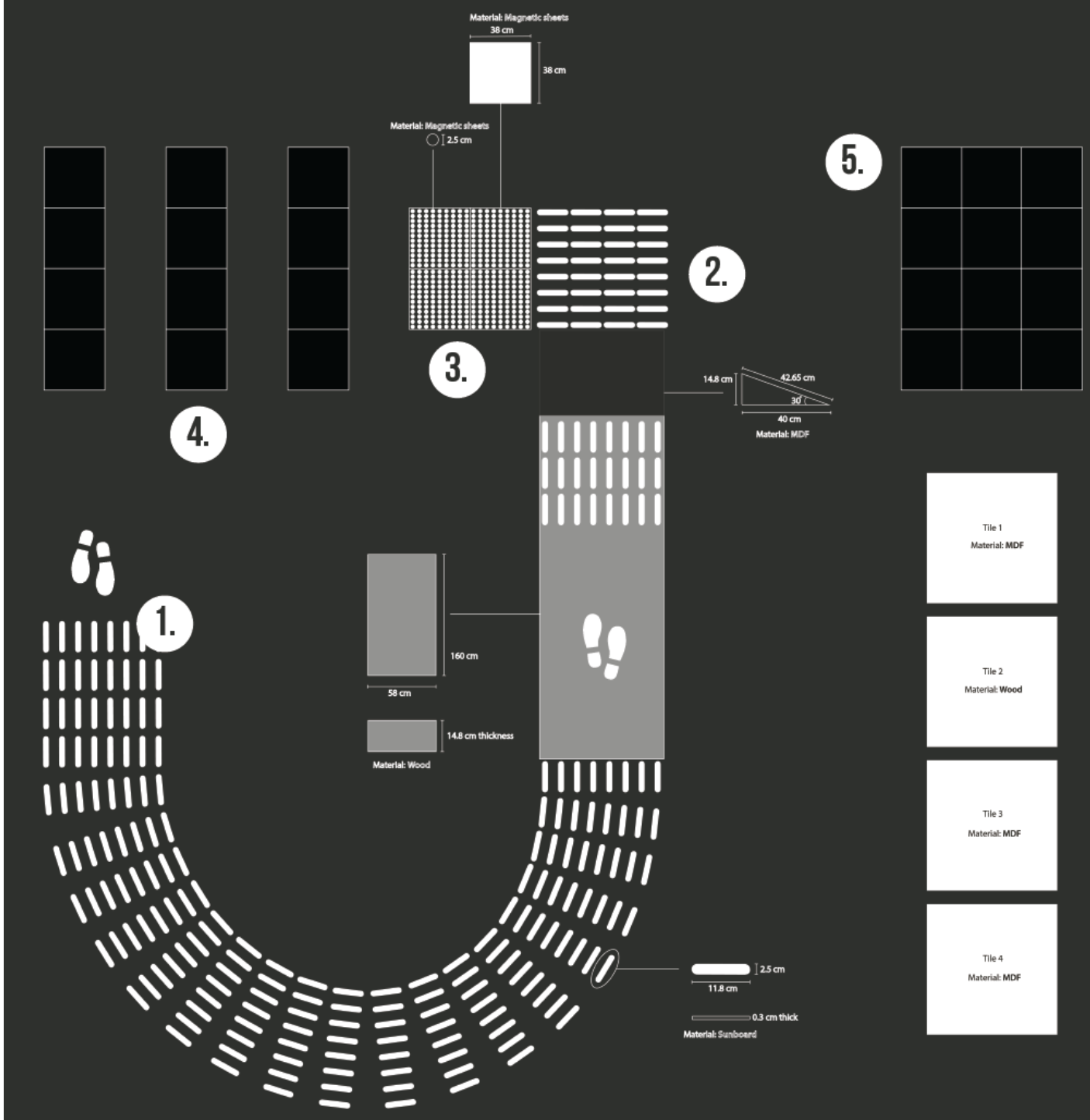
non continous

05 Next the users were asked to cross the road with increasing number of beeps. Any visible changes in speed were noted to test if sound could give them a sense of time.

The users were asked to interact with directional tiles again to check how fast they could identify the direction, once they had learned how to use the tiles.

As the user testing ended, the users were asked to describe their overall experience and share their feelings or give suggestions about the design.

TRUE SCALE MODEL FOR USER TESTING



PARTICIPANTS

The scale model was tested on 13 people with varied degrees of visual impairment. All of them commuted on a daily basis and were of a varied age group between 25-50 years.

The participants also had varied experiences while navigating through spaces.

The assistance used by the participants varied as well. Some of the participants used a walking stick, whereas others did not and completely depended on assistance from others (mainly their children).

User testing Feedback

The textured ground constituting the tiny bumps of tactile pavements, are associated to be a hinderance and hence fail to give a sense of assistance. **Whereas magnetism evokes a feeling similar to that of being guided by somebody, because of the slight tug on the walking stick.**

The users get numb to the force felt due to the magnetism when interacting with a long continuous magnetic tile.

The users preferred the zebra crossing with stripes with distance between them, because it matched their mental model and they could recognise immediately.

Most users said that such tiles could also be used indoors, in spaces like malls, since they were easily able to follow a magnetic path.

Increasing the number of beeps, with reducing time, made users walk faster.
Test tile 1, was the most successful in indicating a direction in the least amount of time

These paver tile are robust , containing **a magnet of half its width**. When places together these tiles create a path with a non continuous magnetic field so that users do not get numb to the force.

The magnet is placed 10 mm below concrete to create optimum amount of surface field strength of 3072 gauss, and is made of Y30 ferrite.

The design considers ease of manufacturing; it contains a spacer, elevating the magnet when being cast.

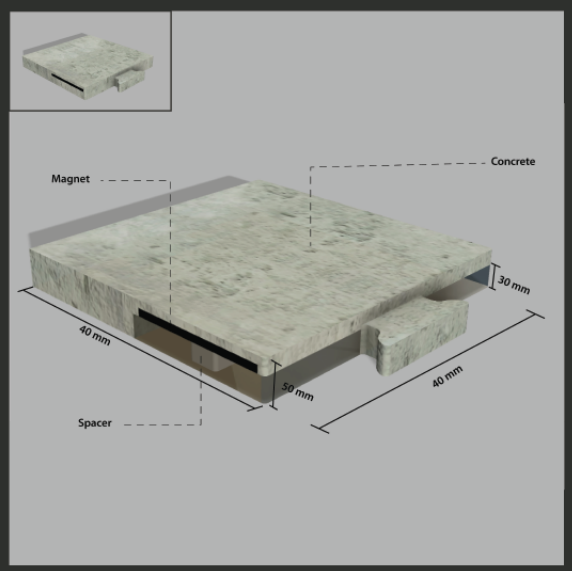
The grooves on the tile help in placing the tiles correctly and also act as an interlocking mechanism.

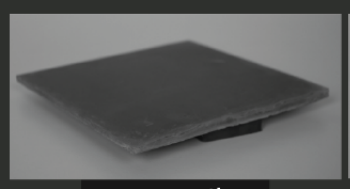
The pavers are seamless with the architecture of the space.

Prototyping

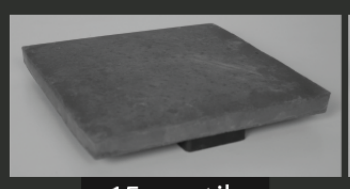
There was need to define the at what depth should the magnet be embedded in the cement tiles to produce the optimum amount of force.

Hence tiles with various heights were tested over a magnet to help define this.




5mm tile


10mm tile


15mm tile


20mm tile

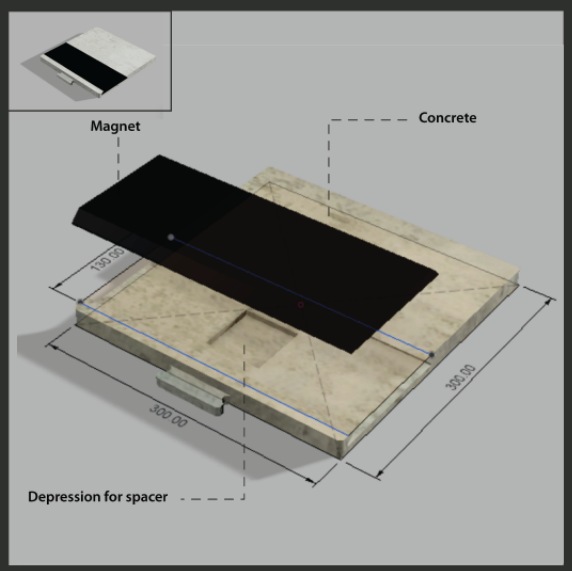
Spaces like malls lack any form of assistance for the visually impaired. These tiles are so seamless and designed in a way that they can be incorporated without affecting the architecture of such places.

Similar to the outdoor pavement, these tiles also contain a magnet of half its width to create a path with a non continuous magnetic field.

The tiles have to be placed under ceramic tiles which are usually used in indoor spaces.

The tile contains a neodymium block magnet of grade N52 to creating a surface field strength of 4174 Gauss for the ceramic tile above.

It also indicates how to place the tiles correctly.



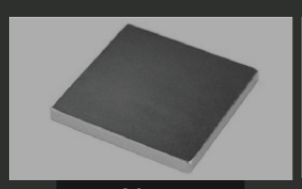
Prototyping

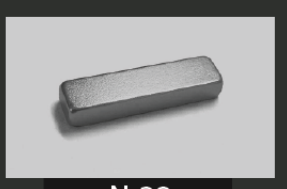
There was a need to find the optimum amount of force needed on the surface of the tile in order to give the users a seamless experience while gliding their stick over the tile. H

ence ceramic tile with various magnets of different surface field strength were tested.


N35


N52


N 42


N 38

M- PAVERS

M- TILES

SYSTEM ELEMENTS

that impart the feeling of being assisted using magnetic force

M- CROSSING

M- CANE

This is a zebra crossing that turns magnetic when it is safe to cross the road and non magnetic when it is not. For this purpose we propose to embed copper windings connected to a power supply, in cement that contains iron fillings. When electricity passes through these coils, the cement being ferromagnetic makes the zebra crossing magnetic !

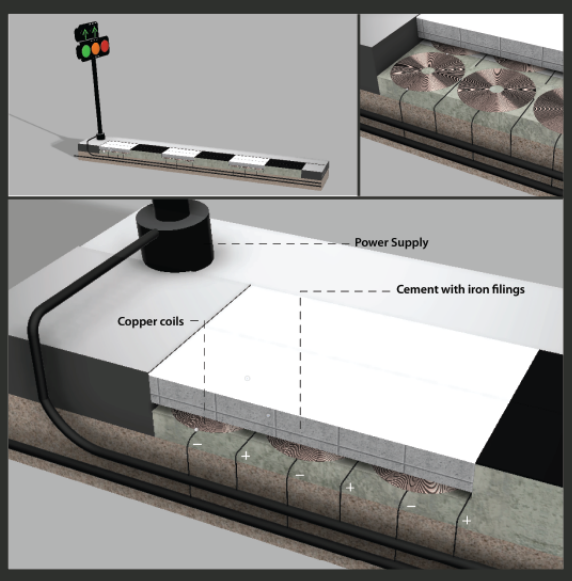
The coils change their magnetic field strength, as time passes. The hall sensor in the sticks of the users detects this change, increasing the number of beeps, to indicate the time left to cross the road.

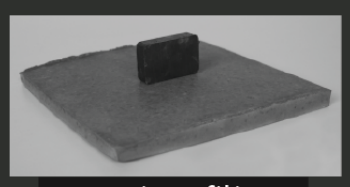
The cement needs to contain 3 part cement to 1 part iron fillings.

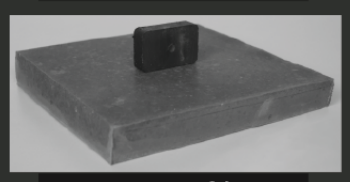
Prototyping

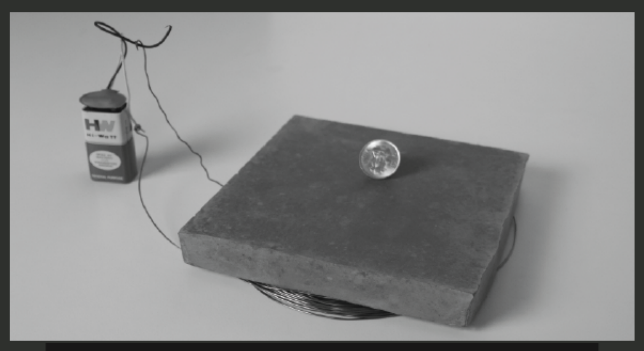
There was a need to explore a method to make the entire tile ferromagnetic. For this, tiles with varied amounts of cement and iron filings were tested.

A copper coil was placed under them, and electricity was passed through the coil. The surface of the tile was then tested for magnetism.




1 cup iron filings


2 cup iron filings


Copper coil

The attachment for the stick has a rolling iron ball at the bottom, so it could glide easily over magnetic tiles.

It also has a hall sensor connected to the speaker at the top, that could detect changes in magnetic field strength to alter the number of beeps to alert the user.