

PROJECT REPORT

AssisTech, IIT Delhi

Designing a reading stand for the visually impaired

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Problem Scope

The project was aimed at designing a reading stand which should be foldable, portable, light weight, compact and easy to assemble & carry. Stand should also bear a phone holding mechanism which can allow adjusting the phone's position in accordance with the orientation of the page. Moreover, height adjustment must be supported by the stand to scan sheets of the likes of A3 size (default being A4). Additionally, the stand must be affordable with the material being readily available.

Technical Review

An existing solution to the problem scope has been scanning stands- with and without in-built camera. Such stands have been unusually priced making it difficult for the user to access them.

Design Requirement

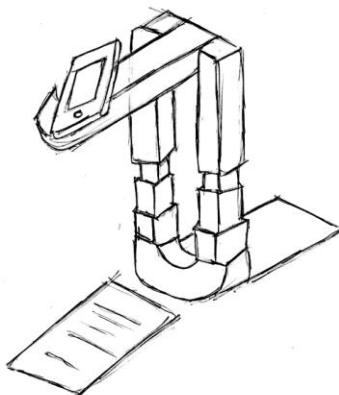
The stand should be of the optimum height, defaulted to fully capture an A4 sheet; should fold, be lightweight and easily hand-held. The structure should be able to bear the weight of the phone/tablet. Device holding mechanism should be reliable enough and could support phone models of various sizes, also adhering to different back-camera positions. The scanning text/tactile sheet should be clearly visible for scanning. Also, the stand should not fall back or front by an accidental push by the user. Not the least, it should be aesthetic, with lesser number of parts which do not break upon falling.

Design Description

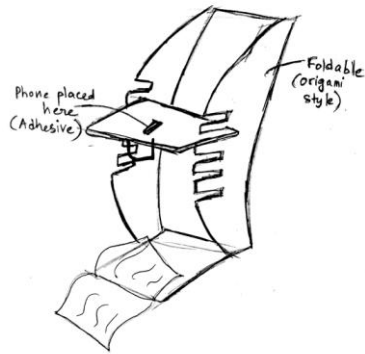
Within the tumultuous efforts of thinking of an appropriate design, I stumbled upon several designs during the process. Below are a few attempts:



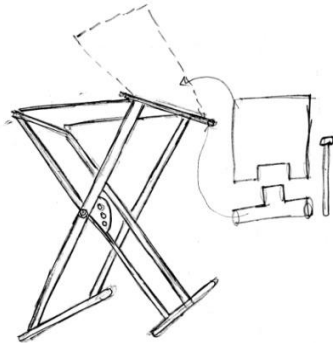
The first design, as shown in the figure consisted of several locking between rectangular strips to adjust the height. The platform holding the device would rotate downwards parallel to the page resting on another hinged plate. The idea could not be implemented due to increased number of parts, and hinging mechanisms. The structure would wobble with improper locking of hinges after placing the device. Increased number of parts would increase the cost too. Moreover, it is prone to breaking on fall.



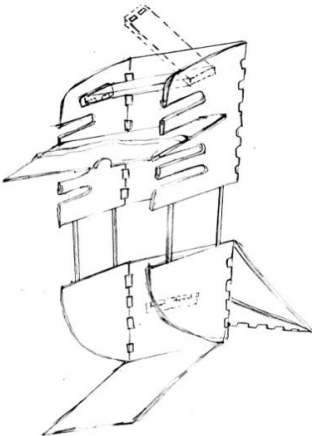
The adjacent design possessed height adjustable mechanism similar to a selfie stick. Although foldable, the material would have increased the cost. Also, there would be a chance of toppling, if the material is not hard enough. Locking and hinges too were a constraint in this design.



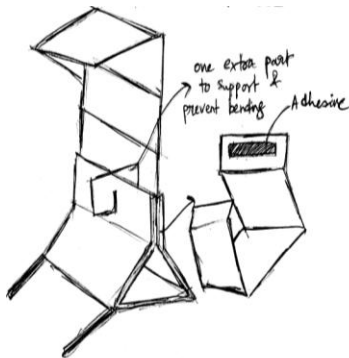
This was proposed to be made with cardboard with no hinges. A separate cardboard which would bear the mobile on it would be inserted into the slots, as shown. The device would get stuck on the adhesive (present on the platform), with sheet placed below it. Here, we could not use adhesives since there was a possibility of spillage which would render the adhesive ineffective after some time. There was also skepticism regarding the sturdiness.



The locking in the adjacent stand is similar to a casio-stand. On pulling the knob, the two inclined rods would open up, thus reducing the height. The steel rods here would have made the stand here and less-mobile.

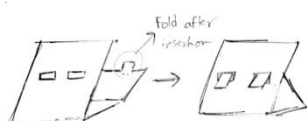


This design was a slight modification of the third listed design. On implementation of the idea by cardboard, the model toppled forward. It thus had to be scrapped.



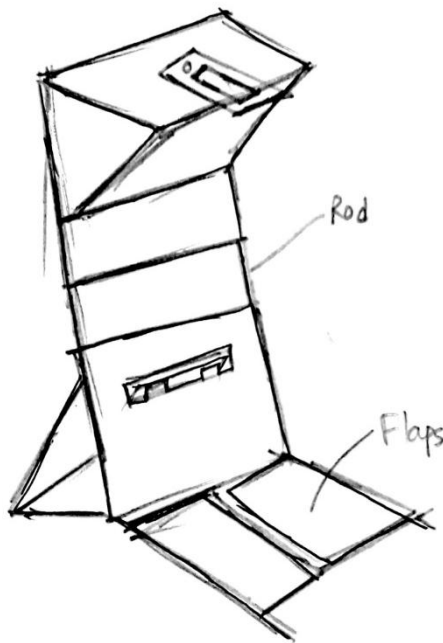
Use of triangle to increase the sturdiness was felt. It was decided to make the base as sturdy as possible, to reduce the wobbling tendency and prevent toppling. Thus rods had to be used for the base too.

In the figure, the extra part for locking the two surfaces was prone to get misplaced. Hence, a substitute had to be thought for the base.



Here, there was no surety if the locking was safe to bear the pressure. Or if such bend would work for the material we were using.

The following **working prototype** was tested with different mobile phones and page sizes:



The stand also comes with 2 flaps at the base, which when opened span the size of an A3 sheet. With tactile markings on the flaps, the user can orient the sheet in landscape. An USB light has been used in cases if the flash is not effective enough.

To facilitate that the user does not touches the device after adjusting the phone in the band, an Android application was also made by me. The application would open the camera by saying “Open the camera” and trigger the OCR application, which would perform the text-to-speech part. The voice command given by the user is recognized offline by the application.

On verifying if the stand works, it was found that there was a slight tendency of wobbling, which could be reduced by optimizing the height. Also, the camera settings need to be configured with a picture size of 13M (4:3) to cover the A4 sheet at default height.

Project Experience

Working on a designing project was altogether a great learning experience. I got to know the various facets of product designing, maintaining cost effectiveness and feasibility. The project also helped me gain an insight into Android Studio and SolidWorks framework.

Acknowledgement

I am thankful to Prof. M. Balakrishnan for providing me an opportunity in contributing to the wonderful initiative of AssisTech for the visually impaired people. I would also like to thank Pulkrit Sapra and Ankita Gulati for guiding me at each step and always inspiring to do something “out of the box”.