

Ergo Application

Final Report

ECE1778: Creative Applications for Mobile devices

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April 9th 2015

Word Count:

1. <i>Introduction.....</i>	<i>526 words</i>
2. <i>Design.....</i>	<i>356 words</i>
3. <i>Statement of Functionality.....</i>	<i>278 words</i>
4. <i>Learnings.....</i>	<i>290 words</i>
5. <i>Contributions & Roles.....</i>	<i>148 words</i>
6. <i>Apper Context.....</i>	<i>280 words</i>
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Total: 2147 Words

**Not including headings, diagrams and references*

We give permission to allow the video presentation and our report to be posted on the course website and ask to be informed of any other posts regarding Ergo's concept or the identities of the Ergo project team. We also give permission to have our source code be made open source.



1. Introduction

CONCEPT AND APPER BACKGROUND

The apper Melissa Tomko had the concept of building an application for encouraging proper mobile device usage for children in a fun and engaging way. This was inspired from her education in Psychology, and Communications and Design, as well as work experience with children as a camp leader. The need from this app socially stems from seeing children using mobile devices too close to their faces or hunched over them. Technological devices are becoming ever more mobile, and children's use of these are growing with it. Hence, intervening at a young age to teach proper ergonomic usage will create habits they will carry forward with them for life.

WHY IS THERE A NEED FOR MOBILE DEVICE ERGONOMICS

There are studies emerging into mobile device usage that stems from research dealing with computer ergonomics and workplace ergonomics to keep people safe when using equipment, technology, and machinery. This has resulted from the recent increases in Computer Vision Syndrome (CVS) and nearsightedness attributed to the mobile revolution. CVS was previously a syndrome tied solely to computer screens causing blurry vision, dry eyes, and general eye strain. However, with the emergence of small mobile device screens, these symptoms appear beyond computer use(Bali et al., 2011; Seongwon et al., 2012). Additionally, David Allamby founder of Focus Clinics in the UK has stated that children are showing an increase in nearsightedness correlated with the increase of the device usage in the mobile revolution. Children are the most at risk of developing nearsightedness as a result of mobile usage(Innis, 2013).

The research supports that the exact metric data for the viewing distance for mobile devices must be no closer than 30cm from the users face Spencer et al.'s (2013). The angle of tilt be within the 30-50 ° range(Pereira et al.,2013). Studies on angle of use tended to have the lower threshold as 30 ° for horizontal viewing(Pereira et al.,2013) and 50 ° for an upper threshold(Shieh & Lee, 2007).

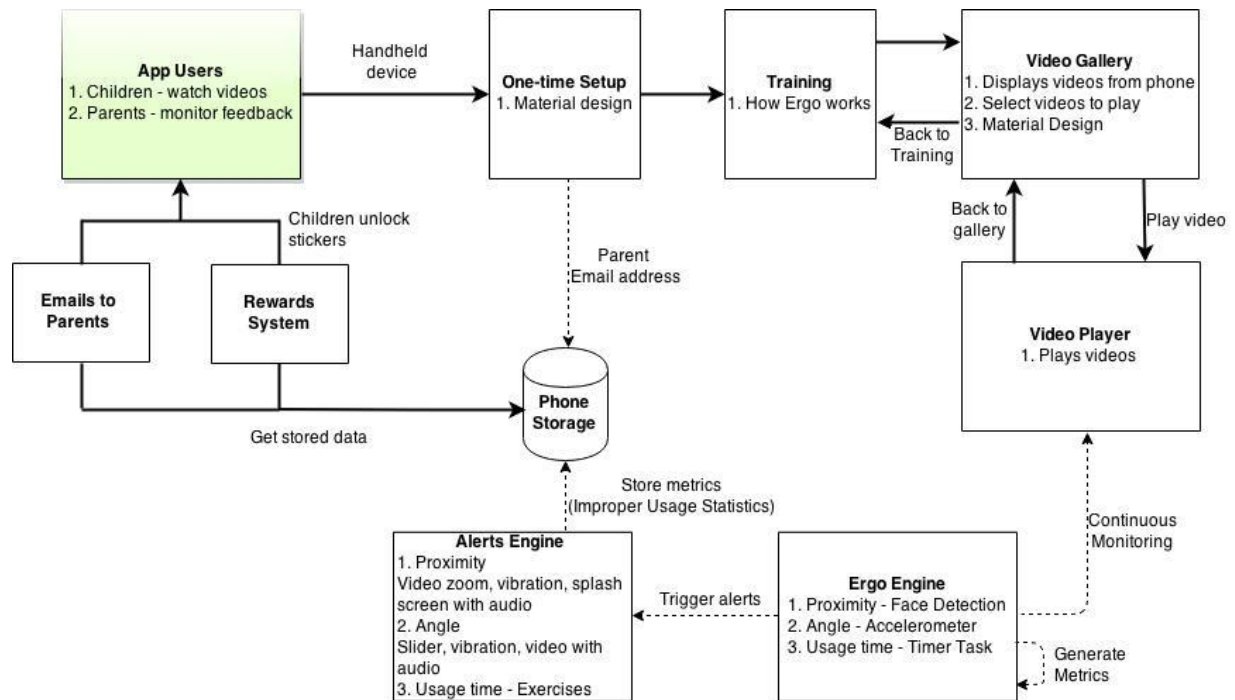
WHO AND WHAT IS ERGO

Ergo is a video playing application that teaches children proper mobile device usage habits, and has periodic exercises to reduce strain of prolonged usage. Ergo is also the name application's avatar that guides the child through the mobile device application. Ergo has instructional tutorials, exercises, and corrections that are audio, visual, and haptic alerts. The



application monitors for improper viewing tilt angle and if the device is being held too close to the user's face. When the user uses the device in a non-ergonomic position, Ergo displays informative alerts indicative to the type of error, with an appropriate correction video. Exercises are presented every 20 minutes interrupting video play, adhering to the 20-20-20 rule(looking for 20 seconds at something 20 feet away, every 20 minutes) and other supporting research on relieving eye and muscle fatigue of using a mobile device. Upon improved video viewing habits, stickers are unlocked as a fun and engaging feature we believe that children will enjoy. Using this application, children will gain mobile ergonomic skills to carry forward for the rest of their life.

2. Design



USERS

A parent or adult mediates the initial use of Ergo. The primary users are children between the ages of 4 and 10.

SETUP AND TRAINING

Setup introduces Ergo's motivation to its users. The only optional input is the parent's email address. Before opening the gallery, a short training video on ergonomics is played.

VIDEO GALLERY

The gallery displays videos from the user's phone. It uses a clean design to provide an easy way for video selection via preview cards. Browsing is enabled with an intuitive vertical swipe motion. The video selection is child safe in that, they cannot accidentally delete videos.

PLAYING VIDEOS

Videos can be played by tapping their preview card.

MONITORING ENGINE

The engine starts once a video is selected for playback and stops when the video ends. It monitors for improper device usage.

Two metrics that are continuously monitored are: device angle and proximity to face. When either crosses a predefined threshold, an alert is sent to the alerts engine to handle the improper usage. A third metric, device usage time, is also tracked for engaging the users in timed eye exercises.

Technologies used:

- A. *Proximity to face*: Uses Android face detection library to draw a transparent rectangle around the face. The size of the rectangle increases as proximity decreases. Also, the detection stops when the face is less than 20cm from the phone.
- B. *Device angle*: Uses the Accelerometer to measure tilt along the Y-axis. The correct angles to hold the device are between 30-50 degrees.
- C. *Usage time*: A Java timertask records the viewing/total usage time as well as when an exercise should occur for the user to take a break

Ergo collects statistics on improper device usage when a 'severe' alert occurs. A severe alert happens when the alert threshold is crossed for tilt or proximity errors. If the parent had set up Ergo with their email address, they will then receive a weekly email with relevant usage statistics.

ALERTS

The alerts engine coordinates with the monitoring engine to intervene when incorrect device usage occurs. It pauses the video playback and shows a cue for the alert. The cues are video, audio, images, text and haptic.

- A. *Proximity Alert:* The video zooms-in as long as the error occurs. After crossing an alert threshold, an image appears requesting the user to ‘back away’ from the screen. Once the device is moved away, the video resumes playback.
- B. *Tilt Alert:* A slider bar shows how far the device has been tilted incorrectly. After crossing an alert threshold, a video is played to show the user the correct tilt direction.

EXERCISES

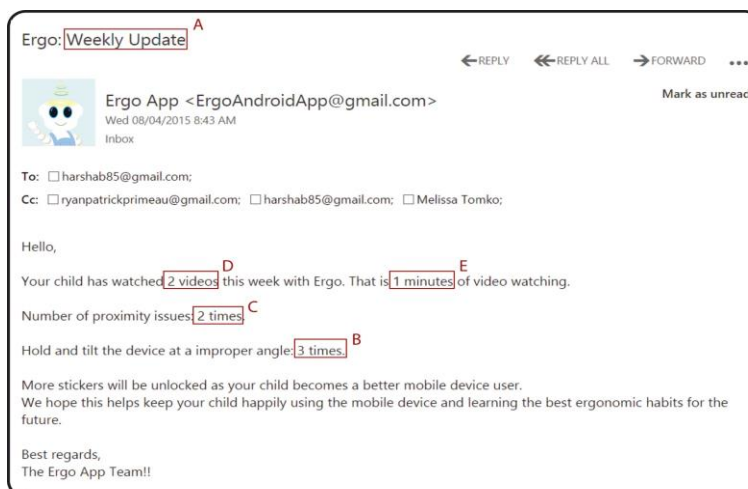
Ergo has periodic exercises to reduce strain of prolonged usage. When the usage timer in the monitoring engine, the user is engaged in an exercise with instructions on to refresh the users eyes.

REWARDS SYSTEM

One of the methods used to correct behavior is positive reinforcement. When a video ends, the rewards system evaluates if the usage during the video is within a predefined tolerance based on data from the monitoring engine. When the condition is met a sticker is unlocked and applied to the video in the gallery.

EMAILS

Periodic emails are sent to parents using the format shown below.



Parents can actively monitor their child's device usage. Using the staitis metrics collected by the monitoring: the Ergo engine sends this periodic email to parents.

This contains the following information:

- A. Current week
- B. Number of tilt errors
- C. Number of proximity errors
- D. Number of videos watched
- E. Number of minutes watched

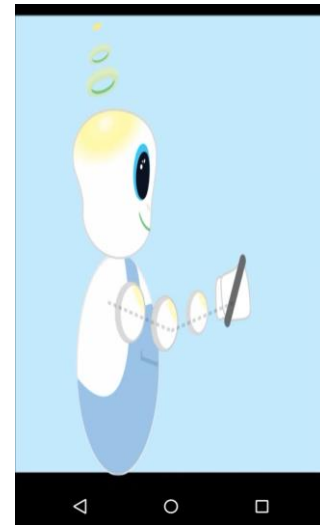
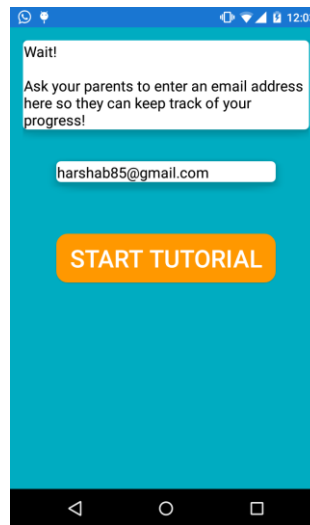
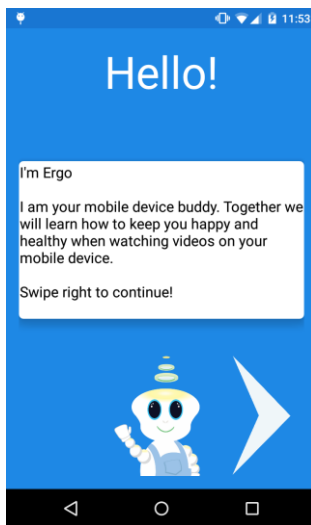


3. Statement of Functionality

WHAT WORKED

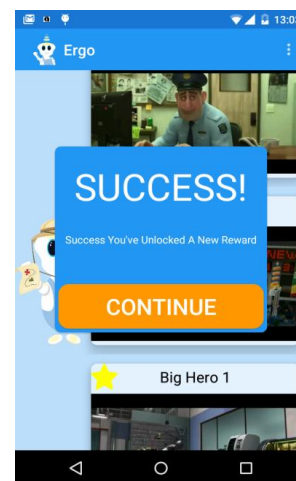
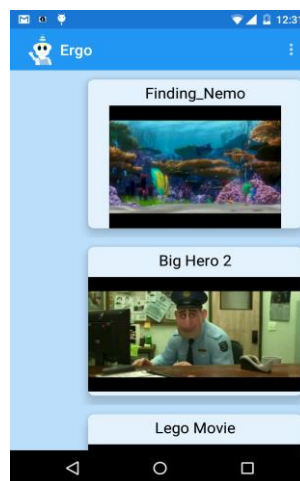
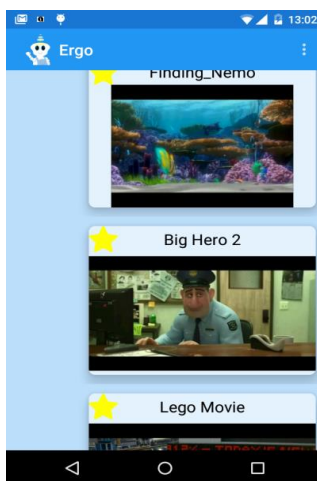
WELCOME SCREEN

Ergo has a very simple one time welcome screen to get the child and parent oriented with the app. It succeeds in getting users into the app quickly.



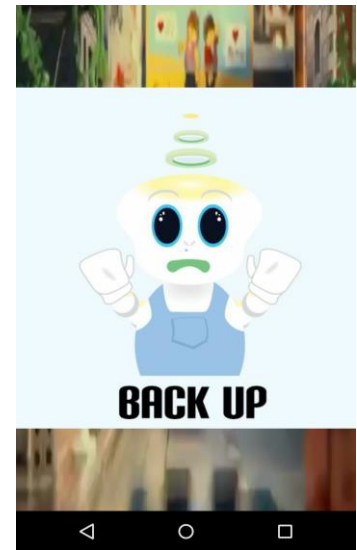
VIDEO SELECTION AND REWARDS

The app places a gold star every time a video is watched until completion. When the user watches a video without triggering too many alerts. They get the "Success" alert below, and unlock an ergo sticker to always remain beside the video.



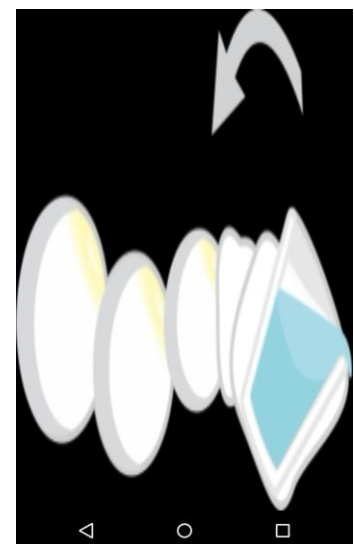
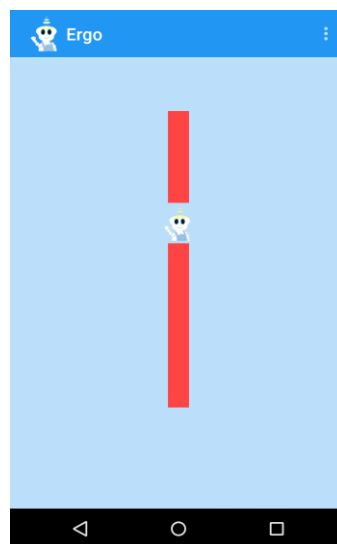
Proximity Alerts

Ergo zooms in the screen when the device is too close to the screen, prolonged proximity has a visual and audio alert telling the user to back up.



TILT ALERTS

Ergo has a tilt bar to match a bubble level in real life, to instruct the user correct the current angle of usage. Prolonged improper tilt has the visual alert on the proper correction required.

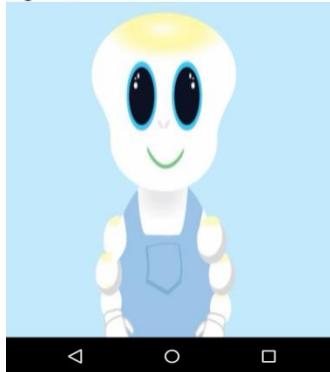




EXERCISES

Ergo has regular eye exercises every 20 minutes of sustained video usage to keep the users eyes refreshed. Rosen (2013)'s ophthalmology study of CVS and potential treatments, encourages ample blinking to keep eyes refreshed to limit dry eyes and blurred vision.

You eyes must be getting pretty tired looking at this screen. A quick way to help our eyes stay alert is to blink. By blinking you make tears that keep your eyes refreshed. Let's blink together.



WHAT DID NOT WORK

Ergo at times, has difficulty detecting angles and proximity to the user. Lighting conditions can sometimes affect the device's face detection, these result in false positives and cause the alerts engine to fire.

The angle is monitored with the Y-axis of the device. In our tests the accuracy could fluctuate. A simple solution would be to take samples points of the angle and calculate the average angle during small time segments. We know that averages have smaller variance than sample points this should significantly improve the accuracy.

4. Learnings

In the beginning of the project, our group was concerned with the accuracy of the sensors and enforcement of proper device usage. Once we knew we could measure the tilt and angle, we began to consider how to strictly enforce of proper device usage. The alert system developed handles alerts and content distortion more aggressively than intended The app throws a storm of visuals, haptics, and sounds to warn the user, in addition to pausing and distorting the content. Starting over we would put a larger emphasis on user experience of the enforcement system.



A solution would be to greatly increase the tolerance of the enforcement and unify the alerts. We could maintain a single **Rank** value that measures how improperly the device is being used in an instant of time. We could use the **Rank** and time to show a progressive alert system.

The current implementation has the content being paused immediately and shows visual, haptics, and sounds with a minor time progression element.

New System: User begins to hold the device 10 degrees outside of the range.

1. Detect user is improperly holding device
2. +0 seconds
3. Begin Slight haptics
4. +5 seconds
5. Stronger haptics + Fade in the tilt bar (if the issue was proximity, begin light zoom)
6. +5 seconds
7. Add Sounds
8. +5 seconds
9. Add visual + pause video
10. +10
11. User is likely away from the device, handle appropriately.

This alternative system gives far more tolerance. The content is only paused as a last resort. The speed between the progressions could be influenced by the **Rank** value. Eventually the user should learn to make fewer ergonomic corrections, and become a better mobile device user even outside of the app.

5. Contributions & Roles

The contributions by group members are depicted in the table below:

Harsha Balasubramanian *Developer*

- Monitoring Engine
- Sensors setup
- Alerts Engine
- Tilt Alert
- Eye exercises
- Embedding audio and videos to alerts
- Data storage (email, setup flags and usage metrics)
- Rewards backend
- Email client

**Ryan Primeau** *Developer*

- Video selection
- Rewards System Frontend - Stickers, and alerts.
- Storage for rewards associated with each video
- Welcome pages
- Tutorial video player
- Tilt bar UI
- Video zoom for incorrect usage
- Material Design app wide
- Set up server for Emails

Melissa Tomko *Apper*

- Contributed the concept of Ergo—teaching mobile device ergonomics for children.
- Researched the metric data requirements, and additional research where needed.
- Created the graphic design of avatars, backgrounds, and icons used in the Ergo app.
- All audio content and textual ‘copy’ content of the app.
- All animations and instructional videos we made using Adobe Photoshop and various audio and video converting softwares

6. Apper Context: Melissa Tomko

The creation and the motivation of the Ergo application combines my educational background, employment experiences, as well as exemplifies my skills and goals toward my career path. Having an undergraduate education in Communications, Cultures, Information and Technology paired with Psychology that delves into the cognitive development, perceptions and capabilities of the human mind, has primed me for the field and career path of user experience design.

Ergo’s application to child user experiences of mobile devices is unique and innovative since there is an ever growing need for optimizing the usability process and reaching a younger audience. My previous employment experiences of working with children and sharing my proficiency in the Adobe design suite provided a multitude of skills and experiences to draw from when designing Ergo. Considering the perspectives of what children find fun and engaging, Ergo was created to improve their overall usability of mobile devices and teach device ergonomics to them on a rudimentary level. This approach and perspective can be applied to technologies beyond mobile devices that children interact with like gaming consoles.

The potential for this approach will become boundless like the emerging technologies that are geared for children are becoming.

Additionally, the usability process extends beyond the visual functionality and navigability of an application, but also into how the use affects the user. Hence, Ergo's thoughtful design to be appealing to children, mindfulness of mobile device ergonomics, and functional design combined is a stepping stone to considering the full user experience of softwares. I intend to continue my research at the iSchool focusing on usability heuristics and optimizing usability to embody the method of design, means for use, and the mode the design is accessed.

7. Future Work

We've compiled a list of additional features and capabilities that should improve the user experience.

Additional and Capabilities:

- Expand the ergonomic positions we detect to also include left and right tilting of the device. We would also give the user suggestions on how to fix the posture for these new positions.
- New eyes exercises to keep the experience from becoming stale.
- Ergo has the potential to become a powerful teaching aid, we could include fun facts for the child to learn and grow. They would focus on ergonomics of mobile usage.
- We would expand the sticker and rewards system. More stickers, more rewards, the ability to unlock new backgrounds and videos.
- Add an element to allow parents to set goals that could lead to real world rewards, given by the parent.
- Include parental approved YouTube and Vine videos into the app.
- Adding more parental controls into the app, such as the amount of videos the child can watch in a single week.
- Increase the tolerance of the alert system using the alternative system from section 4.

The Ergo app excels in the initial goals of the project: ensure and enforce proper ergonomics. It uses the most forceful means available to the device by using a combination visuals, sound, and heptics. The alert system makes it very clear when an error has occurred and informs the user on how to fix the issue. We used tilt bars as a reference to a real world bubble level. The biggest improvements in the app will come improving the experience by toning down the warnings.



References:

- Bali, J., Neeraj, N., & Bali, R. T. (2014). Computer vision syndrome: A review. *Journal of Clinical Ophthalmology and Research*, 2(1), 61.
- Innes, E. (2013, August 15). Have you got 'screen sightedness'? Smartphones are causing sight problems to soar, warns eye surgeon. Retrieved March 1, 2015, from <http://www.dailymail.co.uk/health/article-2394611/Have-got-screen-sightedness-Smartphones-causing-sight-problems-soar-warns-eye-surgeon.html>
- Pereira, A., Miller, T., Huang, Y. M., Odell, D., & Rempel, D. (2013). Holding a tablet computer with one hand: effect of tablet design features on biomechanics and subjective usability among users with small hands. *Ergonomics*, 56(9), 1363-1375.
- Rosenfield, M. (2011). Computer vision syndrome: a review of ocular causes and potential treatments. *Ophthalmic and Physiological Optics*, 31(5), 502-515.
- Seongwon Han, Sungwon Yang, Jihyoung Kim and Mario Gerla "EyeGuardian: A Framework of Eye Tracking and Blink Detection for Mobile Device Users".
- Shieh, K. K., & Lee, D. S. (2007). Preferred viewing distance and screen angle of electronic paper displays. *Applied Ergonomics*, 38(5), 601-608.
- Spencer, L., Iacoponi, J., Shah, S., & Cairns, G. (2013, June). P. 134L: late news poster: resolution limits for smartphones—video playback. In *SID Symposium Digest of Technical Papers* (Vol. 44, No. 1, pp. 1099-1102).