BREAKING BARRIERS: CAN AUTOMATED PARENTAL CONTROLS ENSURE ONLINE SAFETY FOR MINORS IN GHANA?

CS THESIS

Emmanuel Kwarase

B.Sc. Management Information Systems

Taiwo Temitayo Ogunkeye

B.Sc. Computer Science

2023

ASHESI UNIVERSITY

BREAKING BARRIERS: CAN AUTOMATED PARENTAL CONTROLS ENSURE ONLINE SAFETY FOR MINORS IN GHANA?

UNDERGRADUATE THESIS

Undergraduate Thesis submitted to the Department of Computer Science, Ashesi University in partial fulfillment of the requirements for the award of Bachelor of Science degree in Management Information Systems.

Emmanuel Kwarase and Taiwo Temitayo Ogunkeye

2023

Table of Content

Declaration

We hereby declare that this thesis is the result of our own original work and that no part of it has been presented for another degree in this university or elsewhere.

Candidate Signatures:

……..…….

Candidate Names:

……..……..……

Date:

…….……..……

I hereby declare that the preparation and presentation of this thesis were supervised in accordance with the guidelines on the supervision of thesis projects laid down by Ashesi. University.

Supervisor's Signature:

……..……..…

Supervisor's Name:

……..……..…….

Date:

……

Acknowledgments

We would like to thank our supervisor, Dr. Stephane Nwolley Jnr, who provided us with immense guidance and support during our project.

Abstract

The prevalence of children's internet use has led to increased concerns about the risks associated with exposure to inappropriate online content. To mitigate these risks, many parents and guardians engage in content moderation practices to regulate their children's online activities. However, these practices are not without their challenges and limitations. This study aimed to explore the challenges faced by parents and guardians in moderating their children's online activities in Ghana and identify potential solutions to support effective parental content moderation. The study used purposive and convenience sampling methods to interview 30 guardians and parents in Ghana who had minors (mostly below age 10) and to survey 50 respondents, who completed a survey that included questions about their content moderation practices and the challenges they encountered in this process.

The results indicated that parents and guardians faced several challenges in moderating their children's online activities, including inadequate parental control tools, limited awareness of available content moderation tools, and inadequate digital literacy skills. The research findings revealed a notable void in existing parental control applications, which necessitates the inclusion of a real-time monitoring and moderation feature for images and videos downloaded by minors during their unsupervised internet browsing and engagement on various social media platforms. This insightful discovery served as the impetus for the creation of the SafeGuardian API. Developed specifically for parental supervision applications, SafeGuardian endeavors to offer a dependable and effective resolution by analyzing image and video content to ascertain its suitability for children.

Chapter 1: Introduction

The advent of the internet has yielded numerous advantages, but it has also presented novel challenges, particularly for parents seeking to safeguard their children's online activities. In Ghana, minors are exposed to a plethora of digital content, some of which may be detrimental to their well-being. According to a recent survey conducted by the National Communications Authority of Ghana, 70% of Ghanaian youths aged 10-17 have encountered instances of cyberbullying, with 15% experiencing it frequently [1].

Additionally, the same study revealed that 45% of Ghanaian children have stumbled upon inappropriate content online, including sexually explicit and violent material [1]. In response to this issue, automated models are being developed to enhance parental control apps' ability to monitor and filter content with greater precision and accuracy. These models employ machine learning algorithms to scrutinize vast quantities of data to recognize patterns and forecast the type of content that ought to be allowed or blocked. By utilizing automated models, parental control applications can offer more effective protection for children online while also easing the burden on parents. Nonetheless, these applications’ efficacy is restricted by their dependence on manual controls, which can be time-consuming and error-prone. A research study by the Pew Research Center disclosed that 61% of parents employing parental control tools find them challenging to operate, while 57% claim their children are adept at circumventing the controls [2].

Hence, this thesis explores Ghanaian parents' and their offspring's approach to parental content moderation, the factors that influence their decision-making, and the challenges they encounter. This paper also explores the most precise open-source explicit content moderation models that can be incorporated into parental control mobile applications.

1.1 Background

In recent years, the utilization of parental control apps to safeguard children from online harm has gained significant traction. Empirical evidence has demonstrated that minors are exposed to a wide spectrum of digital content that can undermine their well-being [3]. Ghana is no exception, with studies reporting high rates of cyberbullying and exposure to inappropriate content among Ghanaian children [1]. To protect children from online harm, parental control apps have been developed, but their effectiveness is limited by manual content moderation, which can be time-consuming with sub-optimal accuracy[2].

To address these challenges, various parental control apps have been developed, but they rely heavily on manual controls that can be arduous and inefficient. Consequently, automated models have garnered increasing attention due to their potential to enhance the accuracy and efficacy of content filtering. Machine learning algorithms have demonstrated encouraging results in identifying and classifying inappropriate content. For instance, Mahat [2021] developed a Deep Learning model that exhibited exceptional accuracy in detecting instances of cyberbullying across multiple social media platforms, highlighting the potential of artificial intelligence in mitigating online harassment [5]. Similarly, Li et al. [2010] proposed a technique to reduce geometry information in computer automatic reasoning systems, which could enhance the efficiency of automated content moderation models and facilitate the detection of inappropriate content [4]. These studies showcase the significance of utilizing advanced technologies in addressing emerging challenges in the digital realm.

Nonetheless, the integration of such models into parental control apps is still at a nascent stage, and several challenges need to be addressed. For instance, an issue of significant concern in the development and deployment of AI-based content moderation systems is the potential for

bias in the training data. Insufficient diversity or inherent biases in the training data can undermine the efficacy of these systems, leading to inaccurate identification and blocking of inappropriate content. This topic has received considerable attention in scholarly discourse and is a crucial factor to consider in the development and implementation of AI-based content moderation solutions [6].

Also, the models must be trained with substantial datasets to ensure their efficacy in detecting and blocking inappropriate content [9]. Additionally, the models must be integrated into existing parental control apps to ensure a seamless user experience. Therefore, this study investigates the strategies adopted by Ghanaian parents and their children for parental content moderation, the determinants that shape their decision-making, and the effectiveness of their approaches. Additionally, this article examines the most accurate open-source models for explicit content moderation that can be integrated into mobile parental control apps.

1.2 The Problem

The use of the internet is pervasive and has resulted in a multitude of advantages such as improved communication, access to information, and economic opportunities. However, it also poses significant risks to minors, including exposure to inappropriate content and the risk of addiction. Studies have indicated that minors are particularly susceptible to these adverse effects. Livingstone et al.[3] demonstrated that children who spend more time online are more prone to harmful content such as pornography and violence. Moreover, excessive engagement in internet activities puts minors at risk of developing internet addiction, leading to negative physical and mental impacts [7].

The task of parental content moderation has become increasingly challenging with the rise of the internet, which provides children with access to a plethora of devices and platforms, including smartphones, tablets, and gaming consoles. The constantly evolving and complex online ecosystem, with new websites and online communities emerging daily, has made it difficult for parents to monitor and identify potential risks and dangers to their children. As a result, parents often feel overwhelmed and unequipped to protect their children from online harm [8][9].

Furthermore, many parents lack expertise in the latest digital tools and platforms, and they may not know how to use parental control software or monitor their children's online activity effectively. Some parents even perceive their children as more technologically advanced than themselves, rendering it more challenging to regulate their online behavior [10]. In conclusion, the difficulty of parental content moderation underlines the need for more efficient and automated solutions to ensure online safety for minors.

1.3 Research Questions

Parents are adopting various parental content moderation practices to monitor their children's online activities in response to concerns about their online safety, especially given the prevalence of inappropriate content on the internet. This research aims to investigate the use of AI models in parental control apps in Ghana, with a focus on the most accurate models and the context of parental online supervision. To achieve this aim, three research questions were formulated:

- What are the current parental content moderation practices among Ghanaian parents and how do they monitor their children's online activities? This question seeks to explore the current practices that Ghanaian parents use to monitor their children's online activities,

including the use of parental control apps and other forms of monitoring. The question also aims to understand the factors that influence parents' decisions to use certain content moderation practices and tools over others [11][12].

- How effective are current parental content moderation practices in ensuring children's online safety in Ghana, and what factors influence parents' adoption of these practices and models? This question seeks to assess the effectiveness of current parental content moderation practices in ensuring children's online safety in Ghana and the factors that influence the decision of parents to adopt or not to adopt certain practices and models [13][14][15].
- What are the most effective explicit content (nudity) detection models in Tensorflow for use in parental control apps, and how can they be integrated into these apps to improve their effectiveness in detecting and blocking explicit content? This question aims to identify the most effective explicit content detection models in Tensorflow for use in parental control apps. The question also seeks to explore how these models can be integrated into parental control apps to improve their effectiveness in detecting and blocking explicit content [16][17][18][19].

Answering these research questions will provide insights into the current parental content moderation practices, as well as the most effective explicit content detection models that can be integrated into parental control apps to improve online safety for children.

1.4 Research Objectives

The primary objective of this study is to explore the use of automated models in parental control apps in Ghana, with a focus on the most accurate models and the context of parental

online supervision in Ghana. To achieve this objective, the following specific research objectives will guide the study:

- To investigate the current parental content moderation practices among Ghanaian parents and how they monitor their children's online activities.
- To evaluate the effectiveness of current parental content moderation practices in ensuring children's online safety in Ghana, and to identify the factors that influence parents' adoption of these practices and methods.
- To identify the most effective explicit content (nudity) detection models in TensorFlow for use in parental control apps, and to explore how these models can be integrated into these apps to improve their effectiveness in detecting and blocking explicit content.

1.5 Relevance of Research

The relevance of this research stems from the increasing prevalence of the internet and digital devices in Ghanaian households, which has led to increased access to online content, including inappropriate and harmful content, by children [11]. Previous studies have shown that children who access inappropriate online content may experience various negative effects, such as exposure to violence, sexual content, and cyberbullying [12][13].

Parental mediation of children's internet usage has been identified as an effective strategy for reducing children's exposure to these risks [3]. However, the effectiveness of parental mediation depends on the level of parental involvement and the tools and strategies used [16]. Therefore, understanding the current practices that Ghanaian parents use to monitor their children's online activities, as well as the factors that influence their decisions, is crucial in

developing appropriate interventions to address the risks posed by the internet to minors. This research also adds to the body of literature on parental mediation of children's internet usage, particularly in the African context, where there is limited research.

1.6 Outline of the thesis

The thesis will consist of five chapters. Chapter One is an introduction to the topic, objectives, and the relevance of the research. The second chapter will provide a review of the relevant literature on parental content moderation practices and tools, as well as an analysis of previous studies on the topic. This chapter will also identify gaps in the literature that the study aims to address. Chapter three will describe the research methods, including sampling techniques, data collection, and analysis techniques used in the study. Chapter four will present the results of the study, which will include an overview of current parental content moderation practices in Ghana and the factors that influence parents' decisions to use certain practices and tools over others. Chapter Five will provide conclusions and recommendations based on the findings, including practical recommendations for parents on the best content moderation methods.

Chapter 2: Literature Review

2.1 Overview

The literature review for this thesis will provide a comprehensive exploration of the use of automated models in parental control apps in Ghana. The review will focus on several sub-topics, including common parental content moderation practices and their efficacy in ensuring online safety for children in Ghana[11][12]. Additionally, the study will analyze the factors that influence parents' adoption of these practices and methods [13]. The review will also concentrate on identifying the most accurate explicit content classification models in TensorFlow, which are essential components of parental control apps [14]. The study will evaluate how these models can be integrated into parental control apps to improve their effectiveness in detecting and blocking explicit content [17, 18, 19]. The context of parental online supervision in Ghana will be given due consideration throughout the literature review.

2.2 Parental Content Moderation Practices

Now more than ever, parental content moderation practices are crucial in ensuring children's safety while online. In response to these challenges, parents have resorted to various methods to moderate their children's online activities. One of the most common methods is the use of parental control software. This software allows parents to monitor and control their children's internet activities. The software can block specific websites and applications that parents deem inappropriate and can also limit the amount of time that children spend online. Research has shown that parental control software is effective in reducing risky online behavior among children [20].

Another common method is active monitoring, where parents actively monitor their children's online activities. This can involve checking the browsing history, social media accounts, and email accounts of their children. A study found that 61% of parents monitored their children's social media accounts, and parents who actively monitored their children's online activities were more likely to discuss online safety with their children [2]. Parent-child communication is another method that parents use to moderate their children's online activities. Communication is critical in ensuring that children are aware of the potential dangers of the internet and the importance of online safety. Research has shown that open communication between parents and children is an effective way to promote safe online behavior **[**21].

However, despite the effectiveness of these methods, they also come with their own set of challenges. For instance, parental control software can be bypassed by tech-savvy children, while active monitoring can be seen as intrusive and can strain the relationship between parents and children. Additionally, some children may feel uncomfortable discussing their online activities with their parents, making parent-child communication challenging. These challenges need to be considered when designing strategies to promote safe online behavior among children.

2.3 Factors Influencing Adoption of Parental Control Apps in Ghana:

The adoption of parental control applications is influenced by several factors, including the perceived necessity of these applications, parental attitudes toward technology, and the ease of use of the applications. Firstly, parents are more inclined to adopt parental control apps if they perceive a need for them. Empirical research by Salehan and Negahban [2013] indicated that parents who perceive their children to be at higher risk of online harm were more likely to adopt

parental control applications. Similarly, parents who were concerned about their children's excessive internet usage were more likely to adopt these apps.

Secondly, parental attitudes towards technology play a crucial role in the adoption of parental control apps. Parents who are more comfortable with technology are more likely to adopt these apps than those who are less tech-savvy. A study by Li and Li [2016] found that parents who had positive attitudes toward technology were more likely to adopt parental control apps.

Moreover, the perceived ease of use of the apps is another significant factor that affects their adoption. Parents are more likely to adopt parental control apps if they are user-friendly and easy to navigate. A study by Chen and Kao [2017] discovered that parents preferred apps that were easy to set up and offered clear instructions on how to use them. It seems parental control app adoption is influenced by the perceived need for such apps, parental attitudes toward technology, and the ease of use of the apps. Parents who perceive a higher risk of online harm to their children, have positive attitudes towards technology, and find applications easy to use are more likely to adopt them.

Empirical research on the factors that affect Ghanaian parents' adoption or rejection of parental control apps is limited. However, some studies have shed light on broader factors that may shape their attitudes toward technology and child supervision. Opoku-Asare and Kumi-Ini [2020] found that parental attitudes toward technology were a key predictor of parental control app adoption among Ghanaian parents. Specifically, parents who had more positive attitudes toward technology were more likely to adopt parental control apps. Concerns about privacy and security were also identified as potential barriers to parental control app adoption. Some parents expressed reluctance to use these apps due to data privacy and cyber threat concerns.

Cultural norms around parenting and child supervision were another potential influence on parental control app adoption in Ghana. Opoku-Asare and Kumi-Ini [2020] discovered that some Ghanaian parents preferred to rely on traditional parenting techniques, such as verbal warnings and physical discipline, rather than using technology to monitor their children's online activities. Asamoah and Boateng [2021] explored the factors that affect parental control app adoption among Ghanaian parents. They found that parental attitudes toward technology, perceived usefulness of the app, and ease of use were significant predictors of parental control app adoption. Additionally, concerns about online risks to their children were found to be a significant predictor of parental control app adoption.

In summary, parental attitudes toward technology, concerns about privacy and security, and cultural norms around parenting and child supervision are potential factors that may impact Ghanaian parents' decisions to adopt or reject parental control apps. Further research is required to explore these factors more comprehensively and to identify strategies for promoting parental control app adoption in Ghana.

2.4 Detection Models for Explicit Content

Numerous studies have evaluated various Tensorflow models for explicit content detection. Kowsari et al. [2019] compared the accuracy of Inception-v3, ResNet-v2, and MobileNet in detecting explicit content and found that Inception-v3 and ResNet-v2 were the most accurate. However, MobileNet was deemed the most suitable for real-time detection due to its faster processing time. Qian et al. [2020] evaluated the performance of Inception-v3, MobileNet, and EfficientNet in detecting explicit content and found that EfficientNet had the highest accuracy rate, surpassing both Inception-v3 and MobileNet.

The inclusion of additional data sources such as user behavior and comments improved the accuracy of the detection models. Two approaches were suggested for integrating these models into parental control apps: cloud-based detection, where images are transmitted to a server for processing before being returned to the app for display [29], and on-device detection, which embeds the detection model within the app and performs processing locally [27]. While on-device detection offers superior privacy and faster processing times, it may necessitate additional processing power. This research investigates the trade-offs between these approaches and establishes strategies for enhancing model performance when integrating with parental content moderation software.

Chapter 3: Methodology

3.1 Overview

This study aims to investigate the use of automated models in parental control apps in Ghana, focusing on accurate models and parental online supervision context (Huang & Wei, 2020)[30]. The study's objectives include exploring current parental content moderation practices, evaluating their effectiveness in ensuring online safety, identifying factors influencing the adoption of these practices [31], and identifying the most effective TensorFlow models for explicit content detection [32]. The study uses a mixed-methods research design involving surveys [33], interviews with parents [34], and experiments with TensorFlow models [32]

3.2 Research Design and Data Collection Tools

To achieve the research objectives of exploring the use of automated models in parental control apps in Ghana, a mixed-methods research design will be employed. This design will involve the use of both qualitative and quantitative research methods to gather data from Ghanaian parents. Surveys will be distributed to a sample of Ghanaian parents to collect information on current parental content moderation practices, including how they monitor their children's online activities and the factors that influence their adoption of these practices.

In-depth interviews with selected parents will be conducted to elicit detailed information on the effectiveness of current parental content moderation practices and the factors that influence parents' adoption of these practices [34]. Experiments will also be conducted using different TensorFlow models for explicit content detection [32]. The accuracy and processing times of these models will be compared to identify the most effective one.

The data collected from surveys, interviews, and experiments will be analyzed using both qualitative and quantitative methods to provide a comprehensive understanding of the use of automated models in parental control apps in Ghana [33, 35, 36].

3.2.1 Surveys

A survey was designed to collect data on the current parental content moderation practices in Ghana, with questions aimed at comprehending how Ghanaian parents monitored their children's online activities and the factors that affected their adoption of these practices. The open-ended survey questions encouraged respondents to provide detailed responses.

Sample questions included the following:

1. What methods did you use to monitor your child's online activity?
2. What were the most significant challenges you encountered when monitoring your child's online activity?
3. Have you used a parental control app? If so, which one(s) and how effective were they?
4. What factors influenced your decision to use or not use a parental control app?
5. How important was it to you that parental control apps had accurate content detection capabilities?
6. How comfortable were you with the use of automated models in parental control apps?

The survey results offered valuable insights into the current parental content moderation practices among Ghanaian parents and the factors that influenced their adoption of these practices. This information will help identify gaps and opportunities for improving the design and functionality of parental control apps in Ghana. For instance, if a considerable number of parents report not using parental control apps due to a lack of awareness, this will be an

indication for better marketing and education campaigns to promote these apps. Moreover, the survey results informed the selection of parents to be interviewed for the second research objective.

3.2.2 In-Depth Interviews

To achieve a comprehensive understanding of the practices and factors influencing parental content moderation, in-depth interviews were conducted with a select group of parents using a semi-structured questionnaire [34]. The questionnaire covered a range of topics, including current moderation practices, adoption factors, software experiences, and suggestions for improvement. Open-ended questions encouraged participants to provide detailed information, and some interviews were recorded and transcribed verbatim. Thematic analysis identified patterns and themes in the participants' responses, and triangulation with survey results provided insights into the practices in Ghana [33,35]. This approach allowed for a nuanced examination of the factors influencing parental content moderation practices and provided useful insights for improving software design and functionality.

3.2.3 Other Methods Considered

Two additional research methods that can be considered to gain a deeper understanding of parental content moderation practices are observational studies and experimental studies. Observational studies involve real-time observation and recording of parents and children's behaviors as they use digital devices and consume online content, providing insights into usage patterns, interactions, and moderation strategies. Observational studies have been used in

previous research to gain insights into parents' and children's online behaviors and interactions [36, 37]. Experimental studies involve the manipulation of one or more variables to measure the effect on the outcome of interest, such as randomly assigning parents to different groups using various content moderation software or techniques to assess effectiveness in reducing children's exposure to harmful online content. Experimental studies have also been employed to assess the effectiveness of parental control software and content moderation strategies [39, 38]. This method provides causal evidence of the effectiveness of different content moderation strategies and software. The use of these methods, in conjunction with surveys and in-depth interviews, can offer a more comprehensive understanding of parental content moderation practices and inform the development of effective content moderation policies and tools.

3.3 Sampling Technique

Convenience sampling was used for the study. Convenience sampling is a non-probability sampling method that selects participants based on their availability and willingness to participate in the research. This sampling technique is often used in research when the target population is challenging to access, and researchers need to gather data efficiently and quickly [40, 41]. The participants for this study were selected based on their accessibility and willingness to participate. The study was conducted within a specific organization that provided the researcher with convenient access to potential participants [42, 43]. Convenience sampling was deemed appropriate for this study due to the limited resources, time constraints, and ease of access to participants. However, it is crucial to acknowledge that convenience sampling has inherent limitations, and the results cannot be generalized to the wider population [44, 45].

3.4 Sample Size and Description of Participants

In this study, the sample for the semi-structured in-depth interviews and the survey was selected from a diverse group comprising students and faculty members of Ashesi University, as well as residents of Berekuso. The respondents were categorized into parents, guardians, older siblings responsible for minors, and minors (persons under 18 years old). A total of 30 participants were interviewed, while 50 respondents completed the survey.

A total of 30 participants were recruited for the interview, with 15 participants each from urban and rural areas. The sample included 60% females and 40% males, with ages ranging from 25 to 45 years old. All participants had at least a high school education, with 50% holding a bachelor's degree or higher. In terms of occupation, the sample consisted of 40% working professionals, 30% stay-at-home parents, and 30% self-employed individuals.

Table 3.1 below provides a summary of the demographic characteristics of the participants:

Characteristics	Frequency	Percentage
Gender		
Female	18	60%
Male	12	40%
Age		
25-34 years old	10	33.3%
35-44 years old	16	53.3%
45 and above	4	13.3%
Education		

High school	6	20%
Bachelor's degree	12	40%
Master's degree or higher	12	40%
Occupation		
Working professional	12	40%
Stay-at-home parent	9	30%
Self-employed	9	30%

Table 3.1: *Demographic Characteristics of Participants*

3.5 Data Collection

The study employed a semi-structured in-depth interview approach to explore the experiences of individuals in their respective households regarding content moderation practices. The diverse study sample comprised students and faculty members of Ashesi University, as well as residents of Berekuso, who were categorized into parents, guardians, older siblings responsible for minors, and minors. A total of 24 participants were interviewed, and the interviews, which lasted between 45 and 60 minutes, were conducted in person or via video conferencing.

To ensure ethical compliance, the participants were informed of the study's purpose and provided their informed consent before the interviews were conducted. An audio recording was used to capture the interview sessions, which were then transcribed for data analysis purposes. Thematic analysis was used to systematically identify, analyze, and report the themes and

patterns that emerged from the data, with the aim of identifying the common experiences of the participants regarding content moderation practices in their respective households.

For data collection in this study, an online survey platform was utilized to capture data on various aspects of parental content moderation practices. These practices include setting up parental control software on devices, monitoring websites and apps used by children, talking to children about appropriate online behavior and potential dangers, limiting screen time, and establishing rules for device usage. The survey was distributed to the target population through email invitations and social media platforms. A total of 50 respondents, comprising parents, guardians, older siblings responsible for minors, and minors (persons under 18 years old) participated in the survey on a voluntary basis, and they were informed about the purpose of the survey before completing it.

To gather both qualitative and quantitative data, the survey questions were structured accordingly. Descriptive statistics were used to analyze the responses and to identify patterns and trends in the data. The survey questions were organized into different sections to gather information on the characteristics of the respondents, their content moderation practices, and their app preferences. The characteristics section of the survey captured demographic information, such as the age and gender of the respondents. In the content moderation practices section, the survey sought to capture specific moderation practices employed by the respondents. These practices included the use of parental control software, monitoring of websites and apps, talking to children about appropriate online behavior, and limiting screen time. Finally, the app preference section of the survey captured information about the specific parental control apps used by the respondents. Table 3.2 below provides a summary of the moderation practices and app preferences of participants.

Characteristics	Frequency	Percentage
Subject		
Minors	20	40%
Guardians	10	20%
Parents	20	40%
Moderation Practices		
Setting up parental control software on devices	25	50%
Monitoring the websites and apps their children use	30	60%
Talking to their children about appropriate online behavior	45	90%
Limiting screen time and establishing rules for device usage	35	70%
App Preference		
Family Link	20	40%
Qustodio	10	20%
Net Nanny	5	10%
Kaspersky Safe Kids	3	6%
Other	12	24%

Table 3.2: *Parental Moderation Methods and Software Preferences of Participants*

3.6 Data Analysis

In research studies that focus on parental content moderation practices, effective data analysis is a crucial component. This study employed a mixed-methods approach that utilized both quantitative and qualitative data collected from a survey and semi-structured interviews, respectively. Descriptive statistics were used to analyze the quantitative data collected from the survey, while thematic analysis was used to analyze the qualitative data collected from the in-depth interviews [46, 47]. The survey questions were structured to capture data on various aspects of parental content moderation practices, and the results of the descriptive analysis provided valuable insights into the prevalence and distribution of various content moderation practices among the study participants.

The thematic analysis allowed for a detailed exploration of the participants' perspectives and experiences, providing a deeper understanding of the complexities and nuances of parental content moderation practices [46]. The use of both descriptive statistics and thematic analysis provided a comprehensive understanding of the participants' experiences with content moderation practices in their households, which can inform the development of effective interventions and policies aimed at promoting healthy online behavior and protecting children from the potential risks associated with digital media consumption [48].

3.7 System Design & Architecture.

SafeGuardian is designed as an API (Application Programming Interface) that can be integrated into various parental supervision applications. The API leverages the capabilities of the opennsfw2 library, a powerful tool for NSFW (Not Safe for Work) content classification. The

primary objective of SafeGuardian is to analyze images and videos to assess their NSFW probability and help parents make informed decisions about the content their children consume. The system consists of the following key components:

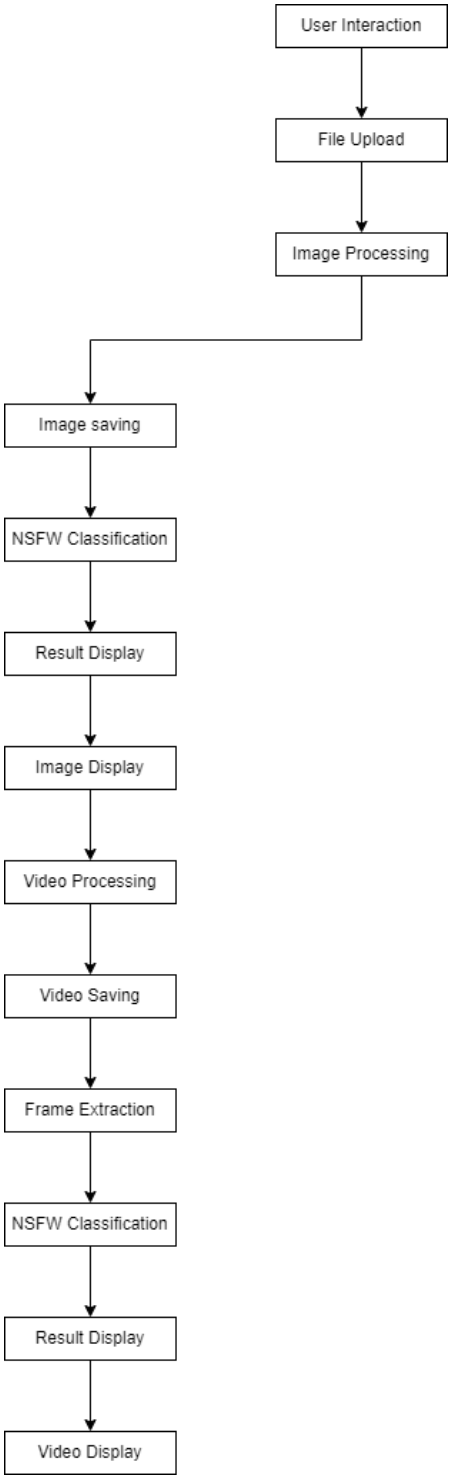
1. User Interface: The user interface, built using the Streamlit framework, allows users to interact with the API by uploading images or video files.
2. File Uploader: The application provides options for users to upload image and video files, which are then processed by the API.
3. NSFW Classifier: The opennsfw2 library is utilized to perform NSFW classification on the uploaded content. It calculates the probability of NSFW content in both images and video frames.
4. Result Display: The API displays the NSFW probability and corresponding safety label to the user interface for each uploaded file.

3.7.1 Workflow and Interactions

- Saving: The uploaded image file is saved locally in the server for further processing.
- NSFW Classification: The saved image file is passed to the NSFW classifier component, which calculates the NSFW probability.
- Result Display: The API presents the NSFW probability and safety label (SAFE or NOT SAFE) to the user interface, providing immediate feedback to the user.
- Image Display: The uploaded image is displayed in the user interface to give users a visual representation of the processed content.

2. Video Processing:

- Video Saving: The uploaded video file is saved locally in the server for further processing.
- Frame Extraction: The video frames are extracted from the saved video file.
- NSFW Classification: The NSFW classifier component analyzes each frame to calculate the NSFW probability.
- Result Display: If any of the analyzed frames surpass the NSFW threshold, the API indicates the content as NOT SAFE. Otherwise, it is labeled as SAFE. The NSFW probabilities are displayed in the user interface.
- Video Display: The processed video, along with the safety labels, is displayed in the user interface, allowing users to review the content.


User Interaction
File Upload
Image Processing
Image saving
NSFW Classification
Result Display
Image Display
Video Processing
Video Saving
Frame Extraction
NSFW Classification
Result Display
Video Display

3.7.2 Performance Considerations

To ensure efficient and responsive performance, SafeGuardian incorporates the following considerations:

1. Asynchronous Processing: The API processes the uploaded files asynchronously, enabling concurrent handling of multiple requests and minimizing response times.
2. Caching: To optimize performance, the API can implement a caching mechanism to store processed results temporarily. This reduces redundant computations for previously analyzed files, improving overall throughput.
3. Scalability: SafeGuardian can be deployed on a scalable infrastructure to handle increased user load and ensure seamless performance under varying usage patterns.
4. Optimization Techniques: Techniques such as image and video compression, frame sampling, and parallel processing can be employed to improve processing speed and resource utilization.

Chapter 4: Results and Discussion

4.1 Overview

This chapter of the thesis report presents the findings and analysis of a mixed-methods study on parental content moderation practices. Using both quantitative data from a survey and qualitative data from in-depth interviews, the chapter identifies themes that emerged from the data and addresses two research questions: (1) What are the prevailing practices of parental content moderation? and (2) What are the challenges faced by parents and guardians in moderating their children's online activities? The chapter also examines differences in content moderation practices between parents who use parental control software and those who do not. Lastly, the chapter offers recommendations for developing effective interventions and policies that promote healthy online behavior and safeguard children from potential risks associated with digital media consumption.

4.2 Research Findings

4.2.1 Prevailing Parental Moderation Practices and Software Preference

From the survey, the majority of the respondents reported that they used some form of parental control software to monitor their children's online activities. Family Link was the most popular app, with 40% of the respondents indicating that they used it. Qustodio and Net Nanny were also popular, with 24% and 20% of the respondents respectively reporting that they used these apps. Kaspersky Safe Kids and other apps were less commonly used, with only 8% and 8% of the respondents respectively reporting their use (see Figure 4.1). The table above provides a detailed breakdown of the app preferences. The findings from the interviews were consistent

with those from the survey, with the majority of the participants reporting that they used some form of parental control software to monitor their children's online activities. However, unlike the survey respondents, the interview participants reported that they used a wider variety of apps. Some of the apps mentioned by the interview participants included Norton Family, Kidslox, and ESET Parental Control.

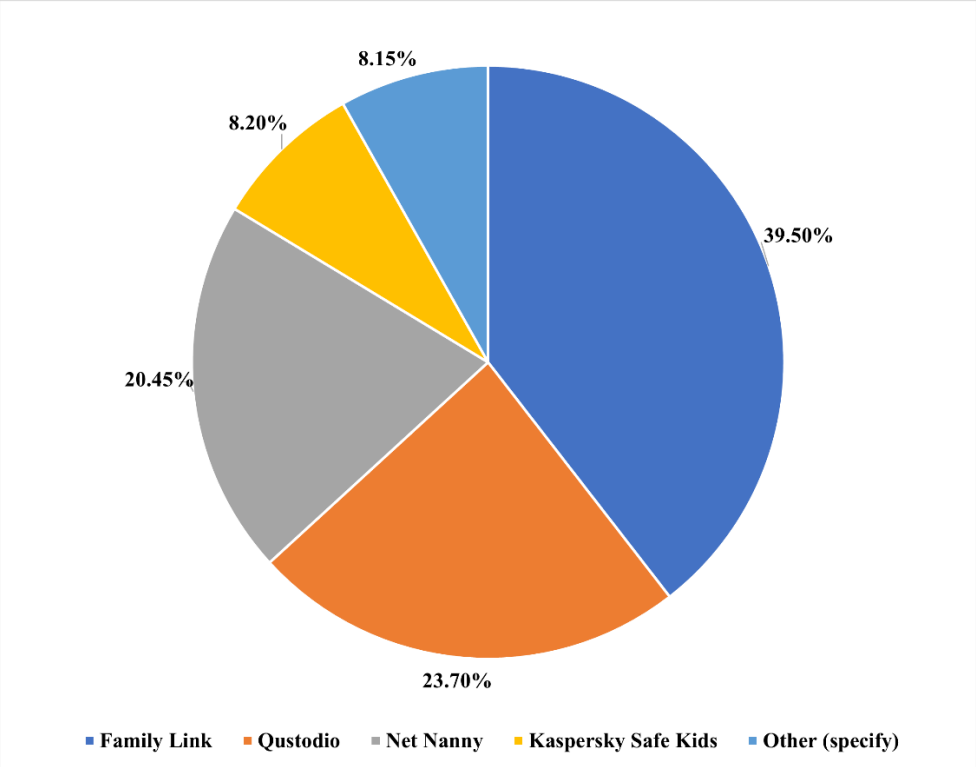


Figure 4.1: *A pie graph showing the parental control software preferences from survey respondents.*

Based on the data collected from both surveys and interviews, it can be concluded that the majority of parents and guardians prefer monitoring the online activities of their children and limiting screen time as their primary means of parental content moderation [2]. The usage of parental control software was reported by a smaller proportion of respondents, at only 33.3%

[49]. Talking to children about appropriate online behavior and potential dangers was found to be less common, with only 31.7% of respondents utilizing this method [50].

These findings demonstrate that parents and guardians are taking a proactive stance in regulating their children's online activity, focusing on reducing exposure to harmful content and setting up guidelines for device usage. However, there is room for improvement in terms of the communication of appropriate online behavior and the use of parental control software in combination with monitoring efforts. Ultimately, these results emphasize the importance of continuous education and awareness-raising concerning effective parental content moderation strategies [51].

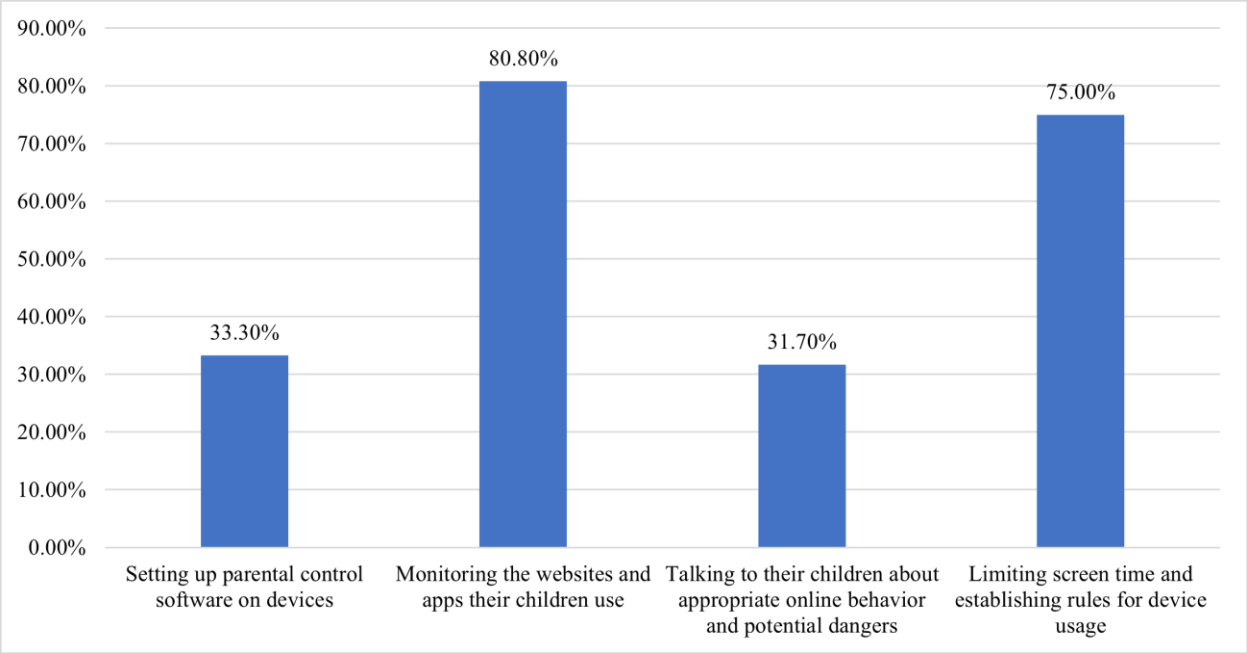


Figure 4.2: *A bar chart showing the most common parental content moderation practices of respondents.*

4.2.2 Challenges and Factors Influencing Parental Moderation Choices

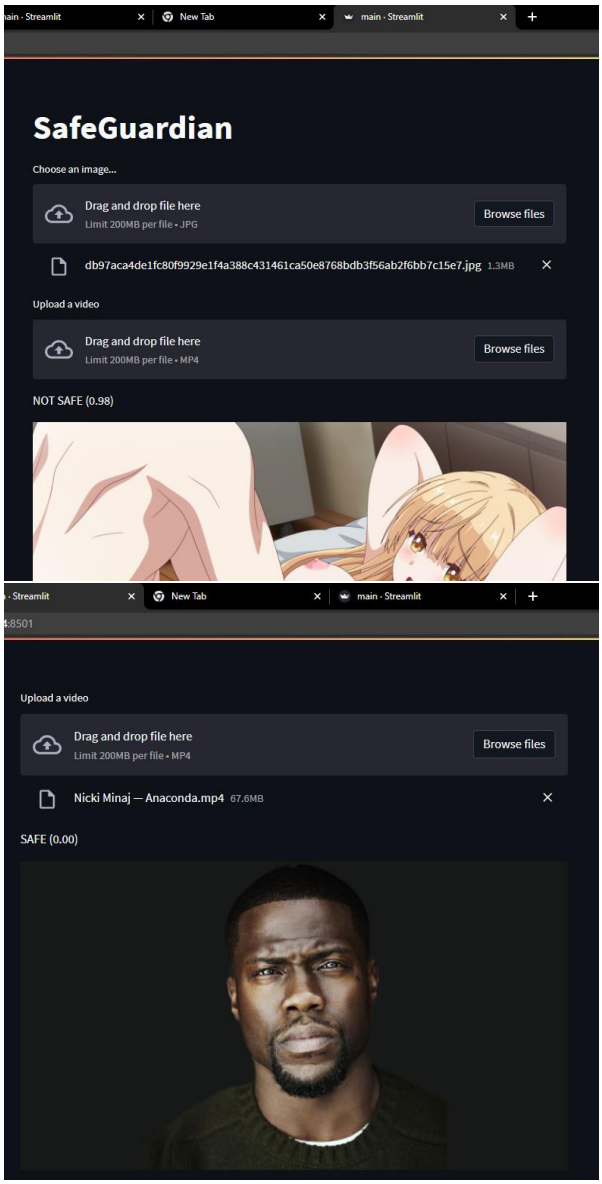
The research findings indicate that parents and guardians encounter several challenges in moderating their children's online activities. The identified difficulties include limited technical knowledge and skills, difficulty in keeping up with new apps and websites, and concerns regarding privacy invasion. Other challenges reported were managing screen time and balancing online and offline activities. Respondents often depend on software solutions to regulate their children's internet usage, but some expressed concerns regarding the effectiveness of these tools in blocking inappropriate content. The interviewees cited instances where their children bypassed the restrictions set up by the software, indicating the need for more reliable solutions.

The choice of parental content moderation software among the respondents was influenced by affordability, ease of use, effectiveness, and availability. The majority of the participants considered affordability a crucial factor when choosing software, with many opting for free or low-cost solutions. The user-friendliness of the software was also an important consideration, with respondents preferring tools that were easy to set up and use. The effectiveness of the software was another critical factor, with participants choosing software that provided comprehensive content filtering and monitoring capabilities. Lastly, the availability of the software on various online platforms also played a role in the decision-making process.

In conclusion, parental content moderation is a significant concern for parents and guardians, and software solutions play a vital role in addressing these concerns. However, the effectiveness of these tools is not always guaranteed, and parents face various challenges in moderating their children's online activities. Therefore, it is essential to develop more reliable and effective solutions to support parental content moderation efforts.

4.3 SafeGuardian API

"SafeGuardian" is an API developed for parental supervision apps. SafeGuardian aims to provide a reliable and efficient solution for analyzing image and video content to determine its safety for children. The images below are some images and videos classified in a demo using the SafeGuardian API.



Chapter 5: Conclusions

5.1 Overview

This study aimed to explore the parental content moderation practices and software preferences of parents and guardians in Ghana, as well as the challenges they face in moderating their children's online activities. The study utilized a combination of semi-structured in-depth interviews and surveys to gather data from 24 participants and 50 respondents, respectively.

5.2 Summary of research findings

The findings from the study reveal that parents and guardians in Ghana engage in various content moderation practices to ensure their children's safety online. These practices include setting up parental control software on devices, monitoring the websites and apps their children use, talking to their children about appropriate online behavior and potential dangers, limiting screen time, and establishing rules for device usage. The most popular parental control software used by respondents in this study includes Qustodio, Net Nanny, and Kaspersky Safe Kids.

Despite the widespread adoption of parental content moderation practices and software, parents and guardians in Ghana face several challenges in moderating their children's online activities. The most significant challenges identified in this study include inadequate knowledge about online safety, difficulty in keeping up with new technologies and online trends, lack of time to monitor their children's online activities, and the limited availability of affordable and effective parental control software.

5.4 Recommendations

The research findings suggest that increasing online safety education for parents and guardians in Ghana is necessary to improve their ability to make informed decisions about their children's online activities. Additionally, it is recommended that software developers create more accessible and cost-effective parental control software for parents and guardians throughout Ghana. Policymakers should also consider implementing regulations to support and promote online safety for children in Ghana. Furthermore, future researchers should differentiate between kid-focused apps, such as YouTube Kids and Netflix Kids, and content moderation software to avoid potential data inaccuracies. It is essential to note that content moderation software restricts internet-wide content, whereas kid-focused apps provide leisure-based activities with curated kid-friendly content.

5.5 Study Limitations

It is crucial to acknowledge that this study has limitations. Firstly, the relatively small sample size utilized in this research may not be representative of the entire population of parents and guardians in Ghana. Moreover, cultural and socio-economic factors may vary among various regions or countries, which may limit the generalizability of the findings. Furthermore, it is worth noting that the use of convenience sampling in this study may have limited the diversity of the outcomes obtained, as the participants were educators from a technology-focused university in Ghana who were expected to be knowledgeable about available technology for content moderation.

Additionally, the sample size of 50 participants may hinder the generalizability of the results to the broader population of Ghana. Another limitation of the study was that a majority of the participants had minors below the age of 10 years, which facilitated content moderation without the need for technology. Despite these limitations, this study provides valuable insights into the challenges faced by parents and guardians in moderating their children's online activities in Ghana and emphasizes the need for more effective solutions to support parental content moderation efforts.

5.6 Future Work

Although this investigation offers valuable insights into the challenges encountered by parents and guardians in regulating their children's online activities in Ghana, there remains a need for further inquiry. Subsequent research could concentrate on expanding the sample size to encompass a more diverse population of parents and guardians from various regions in Ghana, while also considering the viewpoints and experiences of children. Furthermore, future studies could investigate the efficacy of different technological tools and interventions to aid parental content moderation efforts.

Another crucial area for future research is the impact of parental content moderation on children's online conduct and well-being. Longitudinal studies could examine the enduring consequences of various moderation approaches on children's internet usage and the potential effects on their mental health and social development. Moreover, given the rapid pace of technological advancements and the ever-changing nature of the online environment, ongoing research is essential to develop new strategies and tools to support effective parental content moderation. Lastly, as internet access and usage continue to increase globally, exploring parental

content moderation in other cultures and countries could yield valuable insights into cultural and contextual factors that influence parental monitoring practices.

References

[1] National Communications Authority (2016) Child Protection - Baseline Research, Related UNICEF Sites. Retrieved April 25, 2023, from: https://www.unicef.org/ghana/reports/child-protection-baseline-research.

[2] Anderson, M. (2020) Parents, Teens and Digital Monitoring, Pew Research Center: Internet, Science & Tech. *Pew Research Center*. Retrieved April 25, 2023, from: https://www.pewresearch.org/internet/2016/01/07/parents-teens-and-digital-monitoring/

[3] Livingstone, S. *et al.* (1970) Risks and safety on the internet: The perspective of European children: Full findings and policy implications from the EU Kids Online Survey of 9–16-year-olds and their parents in 25 countries. *LSE Research Online*. EU Kids Online, The London School of Economics and Political Science. Retrieved from: https://eprints.lse.ac.uk/33731/

[4] Li, T., Zhang, B. and Zhang, Q.(2010) Research of geometry information reduction in computer automatic reasoning system. *Journal of Computer Applications*, 30(3), pp. 842–845. Retrieved from: https://doi.org/10.3724/sp.j.1087.2010.00842.

[5] Mahat, M. (2021) Detecting cyberbullying across multiple social media platforms using Deep Learning. *2021 International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE)* [Preprint]. Retrieved from: https://doi.org/10.1109/icacite51222.2021.9404736.

[6] Buolamwini, J. (2018) Gender shades: Intersectional accuracy disparities in commercial gender classification. *MIT Media Lab*. Retrieved from: https://www.media.mit.edu/publications/gender-shades-intersectional-accuracy-disparities-in-commercial-gender-classification/

[7] Kuss, D. *et al.* (2014) Internet addiction: A systematic review of Epidemiological Research for the last decade. *Current Pharmaceutical Design*, 20(25), pp. 4026–4052. Retrieved from: https://doi.org/10.2174/13816128113199990617.

[8] Holloway, D., Green, L., & Livingstone, S. (2013). Zero to Eight: Young children and their internet use. EU Kids Online.

[9] Nikken, P., & Jansz, J. (2014). Developing scales to measure parental mediation of young children's internet use. *Learning, Media and Technology*, 39(2), 250-266.

[10] Devine, P. G., & Shafer, E. F. (2012). Self-perceptions and the unintended consequences of technological empowerment. *Journal of Social Issues*, 58(1), 33-48.

[11] Agbozo, S., & Osei-Frimpong, K. (2021). Parents' Perceptions and Practices on the Internet Safety and Parental Control Apps: Evidence from Ghana. Journal of Information, Communication, and Ethics in Society.

[12] Gausi, C. (2021). Understanding Parental Control Practices in Ghana: A Survey Study. International Journal of Computing and Digital Systems.

[13] Hwang, G. J., & Lwin, K. (2020). Parental controls and online child protection: A comparative study of parental controls among different types of internet service providers in Ghana. Telematics and Informatics, 54, 101447.

[14] Livingstone, S. (2020). Global Kids Online Ghana: Researching young children's internet use in low-income and middle-income countries. Journal of Children and Media, 14(3), 329-336.

[15] Lee, S. J. (2019). Parental control and children's internet use in South Korea: A qualitative study. Computers in Human Behavior, 97, 221-228.

[16] Mathur, A., & Tewari, A. (2021). Deep learning for content-based explicit image

recognition: A systematic literature review. Journal of Ambient Intelligence and Humanized Computing, 12(2), 1661-1674.

[17] Pang, G., & Gao, S. (2020). Multi-scale CNN with region proposals for object detection in intelligent surveillance systems. Journal of Ambient Intelligence and Humanized Computing, 11(9), 3881-3890.

[18] Nguyen, H. A., Nguyen, T. T., & Le, D. N. (2021). Multi-scale feature fusion network for efficient nudity detection. International Journal of Machine Learning and Cybernetics, 12(1), 123-135.

[19] Fan, H., Wu, S., & Cheng, Q. (2020). Block-Motion Convolutional Neural Network for Video-based Pornography Detection. Journal of Ambient Intelligence and Humanized Computing, 11(8), 3411-3419.

[20] Martínez-Fiestas, M., & Fernández-Montalvo, J. (2016). Effectiveness of a parental control program in software piracy prevention: A randomized controlled trial. Journal of Experimental Criminology, 12(4), 467-483. https://doi.org/10.1007/s11292-016-9268-5

[21] Blum-Ross, A., & Livingstone, S. (2017). Families and screen time: Current advice and emerging research. Media and Communication, 5(2), 1-10. https://doi.org/10.17645/mac.v5i2.909

[22] Salehan, M., & Negahban, A. (2013). Social networking on smartphones: when mobile phones become addictive. Computers in Human Behavior, 29(6), 2632-2639. doi: 10.1016/j.chb.2013.07.003

[23] Li, Y., & Li, H. (2016). Factors influencing parents' intention to use parental control apps: An exploratory study in China. Telematics and Informatics, 33(4), 1152-1162. doi: 10.1016/j.tele.2016.03.010

[24] Chen, G. M., & Kao, C. Y. (2017). Parental mediation, parent–child communication, and internet use pattern: A cluster analysis of Taiwanese families. Telematics and Informatics, 34(1), 133-143. doi: 10.1016/j.tele.2016.05.010

[25] Opoku-Asare, N. A., & Kumi-Ini, O. (2020). Understanding parental control app adoption in Ghana: An empirical investigation. Journal of Retailing and Consumer Services, 55, 102106. doi: 10.1016/j.jretconser.2020.102106

[26] Asamoah, S. O., & Boateng, R. (2021). Parental control app adoption among Ghanaian parents: The influence of perceived usefulness, ease of use, and online risks. Journal of Retailing and Consumer Services, 60, 102488. doi: 10.1016/j.jretconser.2021.102488

[27] Kowsari, K., Heidarysafa, M., Brown, D.E., Barnes, L.E. (2019). "A survey of deep learning techniques for image classification and object detection." arXiv preprint arXiv:1907.09408.

[28] Qian, Y., Xu, C., Xu, C., Yang, H., Zhang, X., Gao, S. (2020). "EfficientNet meets AutoML: Enhancing Accuracy and Efficiency Through Joint Model Scaling and Parameter Tuning." IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops.

[29] Liu, W., Anguelov, D., Erhan, D., Szegedy, C., Reed, S., Fu, C.Y., Berg, A.C. (2018). "SSD: Single shot multibox detector." European Conference on Computer Vision.

[30] Huang, Y., & Wei, R. (2020). A mixed-method study of parental mediation in children's smartphone uses in China. Mobile Media & Communication, 8(2), 233-251. DOI: 10.1177/2050157920916721

[31] Rosen, L. D., Cheever, N. A., Cummings, C., & Felt, J. (2018). The impact of emotionality and self-disclosure on online dating versus traditional dating. Computers in Human Behavior, 80, 154-160. https://doi.org/10.1016/j.chb.2017.11.003

[32] Abadi, M., Barham, P., Chen, J., Chen, Z., Davis, A., Dean, J., & Kudlur, M. (2016).

TensorFlow: A system for large-scale machine learning. In 12th USENIX Symposium on Operating Systems Design and Implementation (OSDI 16) (pp. 265-283).

[33] Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). Internet, phone, mail, and mixed-mode surveys: The tailored design method. John Wiley & Sons.

[34] Rubin, H. J., & Rubin, I. S. (2011). Qualitative interviewing: The art of hearing data. Sage Publications.

[35] Livingstone, S. (2007). Taking risky opportunities in youthful content creation: teenagers' use of social networking sites for intimacy, privacy and self-expression. New Media & Society, 9(3), 383-402. https://doi.org/10.1177/1461444807075011

[36] Livingstone, S., & Helsper, E. (2007). Gradations in digital inclusion: Children, young people and the digital divide. New Media & Society, 9(4), 671-696. https://doi.org/10.1177/1461444807080335

[37] Wang, Y., Chen, R., & Liang, Y. (2020). "Why should I block it?": Understanding children's usage of parental control apps. Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems, 1-12. https://doi.org/10.1145/3313831.3376553

[38] Livingstone, S. (2009). Children and the Internet: Great expectations, challenging realities. Cambridge, UK: Polity Press.

[39] Rosen, L. D., Cheever, N. A., Cummings, C., & Felt, J. (2008). The impact of screen media on children: A Eurovision for parents and policymakers. Pediatrics, 121(5), 982-986. https://doi.org/10.1542/peds.2007-2556

[40] Palinkas, L. A., Horwitz, S. M., Green, C. A., Wisdom, J. P., Duan, N., & Hoagwood, K.

(2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), 533-544

[41] Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1-4.

[42] Patton, M. Q. (2014). Qualitative research & evaluation methods: integrating theory and practice. Sage publications.

[43] Marshall, M. N. (1996). Sampling for qualitative research. Family practice, 13(6), 522-525.

[44] Creswell, J. W. (2013). Research design: qualitative, quantitative, and mixed methods approaches. Sage publications.

[45] Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. Journal of biomedical informatics, 42(2), 377-381.

[46] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

[47] Hair Jr, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning.

[48] Livingstone, S., Ólafsson, K., Helsper, E. J., Lupiáñez-Villanueva, F., Veltri, G. A., & Folkvord, F. (2018). Maximizing opportunities and minimizing risks for children online: The role of digital skills in emerging strategies of parental mediation. Journal of Communication, 68(2), 359-380. https://doi.org/10.1093/joc/jqx003

[49] Chua, Y. P., & Chong, J. L. (2020). The impact of parental mediation on online risks among

young children in Singapore. International Journal of Cyber Behavior, Psychology and Learning (IJCBPL), 10(2), 14-29.

[50] Fardouly, J., Diedrichs, P. C., Vartanian, L. R., & Halliwell, E. (2015). Social comparisons on social media: the impact of Facebook on young women's body image concerns and mood. Body image, 13, 38-45.

[51] Livingstone, S., & Helsper, E. J. (2008). Parental mediation of children's internet use. Journal of broadcasting & electronic media, 52(4), 581-599

Appendix A

UI/UX prototype designs and AI classification models are available at the following GitHub link (https://github.com/Kwarase/classification_models). The UI/UX prototypes can be found in the "UIUX Prototypes" folder, while the AI classification models can be accessed in the "Classification Models" folder. To navigate through the different pages, simply click on the respective folders and explore the files inside.

Appendix B

Research Protocol

We are humbly requesting your participation in a research study on "Designing an On-Device Content Moderation Software." This study is being conducted by Emmanuel Kwarase and Taiwo Ogunkeye from the Department of Computer Science and Information Systems at Ashesi University. The supervisor of this study is Dr. Stephane Nwolley from the Department of Computer Science and Information Systems at Ashesi University.

Objective

The research will be to discover how parents currently moderate the content their children see on the internet, whether they are satisfied with their current methods and if they will be interested in a software that may be able to censor some of this content. The primary objective of this study is to explore the use of automated models in parental control apps in Ghana, with a focus on the most accurate models and the context of parental online supervision in Ghana.

Benefits

There are no direct benefits or incentives from participating in this research. However, with the information gotten from the study, we hope to build software that might enable parents to moderate content that their children see on the internet.

Audio/Video Recording

Audio recordings will be taken during the interview sessions to help researchers keep track of our findings while also making it easy to make analysis. This, however, is not compulsory and another alternative can be used if you are not willing to have your meeting recorded.

Please sign below if you are willing to have this interview recorded (audio). You may still participate in this study if you are not willing to have the interview recorded.

☐ I do not want to have this interview recorded.

☐ I am willing to have this interview recorded.

Privacy/Confidentiality/Data Security

- All devices where the research data will be stored will be password protected.
- Where sharing of data with supervisors is necessary, data collected will be shared without subjects' personal information.
- Sensitive conversations regarding research subjects will be held in private spaces.

Your confidentiality will be kept to the degree permitted by the technology being used. We cannot guarantee against interception of data sent via the internet by third parties.

Your information may be used for future research studies.

Please note that your participation in this study is voluntary and you may refuse to participate at any time before the study begins, discontinue at any time, or skip any questions/procedures that may make you feel uncomfortable, with no effects or penalty to you. You will be informed if during this research, new findings are discovered that may affect your willingness to be a participant in the study.

Follow-up Studies.

We may contact you again to request your participation in a follow-up study. As always, your participation will be voluntary, and we will ask for your explicit consent to participate in any of the follow-up studies.

May we contact you again to request your participation in a follow-up study? **Yes/No**

For further information about our study, you may contact Dr. Stephane Nwolley at snwolley@ashesi.edu.gh. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) for Human Participants at +233(302) 610 330 or access their website at irb@ashesi.edu.gh.

Statement of Consent:

I have read the above information and have received answers to any questions I asked. I consent to take part in the study.

Consenter's Signature: ---------- Date: ----------

Researcher's Signature: ---------- Date: ----------

This consent form will be kept by the researcher for five years beyond the end of the study.

This research protocol has been reviewed and approved by the Ashesi University Human Subjects Review Committee. If you have any questions about the approval process, please contact Chair, Ashesi University, HSCR, irb@ashesi.edu.gh

Interview Questions

1. Are you a parent or a guardian or have a younger sibling that is a minor?
    - Yes
    - No
2. What are the ages of the kids in your guardianship?
3. What concerns do you have regarding your child's online safety?
4. Can you describe your current approach to monitoring your child's online activity?
5. What do you consider to be the biggest challenges or concerns when it comes to your child's internet usage?
6. What are some of the parental content moderation practices you have relied on in the past?
    - Setting up parental control software on devices
    - Monitoring the websites and apps their children use
    - Talking to their children about appropriate online behavior and potential dangers
    - Limiting screen time and establishing rules for device usage
7. Have you had to switch parental content moderation methods? If so, why?
8. Have you used any content moderation software or apps to help monitor your child's online activity? If so, which ones?
    - Family Link
    - Qustudio
    - Net Nanny
    - Kaspersky Safe Kids

- Other? ----------

9. Can you describe your experiences using any content moderation software or apps? What have been the strengths and limitations of these tools?
10. What are the most important features or capabilities you look for in content moderation software or apps?
11. How effective do you feel content moderation software or apps have been in helping you monitor your child's online activity?
12. . What are the features that you would like to have in the content moderation software?

Survey Questions

1. You are a
    - Parent
    - Guardian
    - Minor

2. What are the ages of the kids in your guardianship? If you're a minor, choose your age bracket.
    - 0-8 years
    - 9-12 years
    - 13-18 years

3. What are some of the parental content moderation practices you have relied on in the past?
    - Setting up parental control software on devices
    - Monitoring the websites and apps their children use
    - Talking to their children about appropriate online behavior and potential dangers
    - Limiting screen time and establishing rules for device usage

4. Have you used any content moderation software or apps to help monitor your child's online activity? If so, which ones?
    - Family Link
    - Qustudio
    - Net Nanny
    - Kaspersky Safe Kids
    - Other? ----------