

A CONTEXT-AWARE INTELLIGENT COMPUTER PARENTAL CONTROL AND REWARDING MANAGEMENT APPLICATION USING ARTIFICIAL INTELLIGENCE AND COMPUTER VISION

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ABSTRACT

In this project, we propose a solution to the problem of children's exposure to harmful content on their mobile devices [5]. Our solution involves an application that monitors the content that children view on their devices and alerts parents or guardians if any potentially harmful content is detected. The application utilizes natural language processing and machine learning technologies to analyze the content of messages and images [6][7].

We faced several challenges during the development of our application, including ensuring that the application remained easy to use while providing accurate analysis of the content. We also had to ensure that the application could run smoothly on a variety of mobile devices with different operating systems [13].

To test our application, we conducted experiments in various scenarios, such as monitoring children's device usage during playtime, study time, and bedtime. Our results showed that our application was highly effective in detecting potentially harmful content, and it was well-received by parents who tested it.

Our idea is ultimately something that people should use because it provides an additional layer of protection for children against harmful content. With the increasing prevalence of mobile devices in children's lives, there is a growing need for solutions that help parents monitor and regulate their children's device usage. Our application provides an easy-to-use and effective solution to this problem.

KEYWORDS

Parental Control, Management, Artificial Intelligence, Computer Vision

1. INTRODUCTION

The two experiments were conducted to evaluate the effectiveness of an AI analysis component and screenshot feature in a parental control app [8]. The first experiment tested the accuracy of the AI analysis component by comparing the results with manual human analysis. The results showed that the AI analysis component was highly accurate, with a success rate of 80%, which

indicated that it could be relied upon to provide parents with accurate information about their child's online activities.

The second experiment evaluated user satisfaction with the screenshot feature, which allows parents to monitor their child's computer usage by taking screenshots. The results indicated that the majority of users found the feature easy to use and that it was effective in helping them monitor their child's computer usage. The high level of satisfaction with the screenshot feature suggests that it is a valuable tool for parents who want to keep their child safe online.

Overall, these experiments showed that the AI analysis component and screenshot feature were effective tools in helping parents monitor their child's online activities. The high accuracy of the AI analysis component and the high user satisfaction with the screenshot feature suggest that these tools can be relied upon to provide parents with the information they need to ensure their child's online safety.

Nowadays, there are many parents who are having trouble managing their kids using their laptops. They would not know what their kids are doing on their device. Studying? Or gaming? As time passes, children will form the habit of gaming while they are supposed to do their homework or work on their school project. It is not good for their future. As far as I know, about ninety percent of the parents that I know have this problem. Their kids are playing games on their PC or laptop out of control. I have heard of things similar to this for so many times and there are so many examples. I remember I have this friend of mine. When he was in middle school, it is not exaggerated that he was one of the students that had the top grades. Nearly on every test, he got at least a 95 out of 100. However, when someone introduced a game to him, he tried it and got addicted to it. He plays it everyday and sometimes he plays for hours each time. He started to miss homework and failed the tests. Sometimes he played for too long and slept late at night. Even worse, he gets up at 3 am just to play the game without his parents knowing, which made him late for school. It is just terrible to imagine how playing games for too long and not doing our own work. Therefore, I got the inspiration from these kinds of things to develop an app.

The three methodologies reviewed are Sahu's digital agent, Kumar's location-based tracking app, and Amato's image tracking app [9]. Sahu's approach focuses on monitoring program usage based on a hardcoded set of rules, which limits its flexibility to manage new programs. Kumar's app tracks children's location via their phone's SIM card, while the focus of our app is on mental safety by tracking the content children view and promoting time management [10]. Amato's app tracks images, but it may not be as accurate as our direct approach. Our solution checks content without relying on specific program names and is more effective and flexible. However, a potential shortcoming of our approach could be that it may not capture all activities, such as those in private messaging apps. To improve on these works, our project utilized AI analysis to accurately identify and categorize screenshots of children's laptop activities, providing parents with a comprehensive overview of their child's computer usage for better monitoring and ensuring their child's online safety.

There are some products that help the parents by blocking specific websites and online apps on the wifi [14]. That solves the problem but they can't do anything when the kids are playing offline games or when they use the hotspot on their phone. For instance, if you are using Google Fiber as your wifi in your house, there is an app that can see the activities of the devices that are connected to the wifi. It is really useful and the time that wifi stops can even be scheduled. Nevertheless, there are still some disadvantages. It cannot do anything to the device that is not connected to the specific wifi. In contrast, the aforementioned app that I am currently working on solves the foregoing phenomenon perfectly. Once you install the app both on your phone and the laptop that you want to monitor, the app starts to take screenshots and they will be sent to your phone with an AI's guess of what your kid is doing on his laptop just in case you are not sure.

This is different from other products. It is more convenient, easier, more thoughtful, and helpful. Also, the screenshots taken will be saved to the history with the time recorded so that parents can see what their kids are doing on their computers.

2. CHALLENGES

In order to build the project, a few challenges have been identified as follows.

2.1. Identify Accurate Applications

The AI analysis component of your app plays a crucial role in ensuring that parents can monitor their child's online activities accurately. As technology has become a central part of daily life, it is more important than ever for parents to keep track of their child's computer usage. However, it can be challenging to accurately identify which applications the child is using, especially if they are using the computer for both productive and non-productive activities. This is where the AI analysis component comes in. By analyzing the screenshots of the laptop, the app can provide accurate results, allowing parents to ensure that their child is using the computer for the right purposes. This is particularly important as misidentification can lead to misunderstandings between parents and children. For example, if the AI mistakenly identifies gaming applications as study tools, the child may miss out on important assignments and studies. Therefore, it is crucial to ensure that the AI analysis component is developed with high-quality algorithms and data, as it is the foundation for providing accurate results. By doing so, parents can have peace of mind, knowing that their child is using the computer safely and productively.

2.2. The Latest Screenshot

The latest screenshot feature within your app is a crucial element in making the app user-friendly and accessible to parents who may not be tech-savvy. By simplifying the process of obtaining information about their child's activities on the laptop, parents can quickly and easily check in on their child's computer usage without the need for complex navigation or technical skills. This feature not only enhances the convenience of the app but also makes it more attractive to potential users, particularly those who may be hesitant to use technology. By providing a simple and intuitive user experience, your app can help parents to stay informed and ensure their child is using the computer safely and productively.

2.3. The Compatibility of the Coding Application and the Chip of Your Laptop

During the development of your app, you encountered a technical issue with the compatibility of the coding application and the chip of your laptop. This led to slow processing and inefficient data uploading to the app's database. As a result, you were unable to move forward with the development process as planned. To solve this issue, you had to search for an alternative website or application that would work with your laptop's chip. This required additional research and testing to ensure that the chosen application would meet the app's requirements and provide the necessary functionality. While this setback may have caused delays in the development process, your ability to adapt and find a solution highlights your resourcefulness and problem-solving skills. By finding a compatible application, you were able to overcome the technical challenge and continue with the development of your app. This is a valuable lesson in perseverance and the importance of being able to adapt to unexpected challenges in the app development process.

3. SOLUTION

Please describe the overview without using bullets and numbers.

There are three main aspects of the app. The most important one would be the screen monitoring. It is virtual for the whole app because that is the data input origin where it takes and sends screenshots to the AI server [11]. If this major component does not exist in this whole project, the app will not be able to function because it doesn't have a date input for AI to analyze it. Speaking of AI, the second part of the app is the AI server. It really matters in this app because some parents are not very sure about what their kids are doing or what they are working on. Therefore, we need "something" that can help parents to be knowledgeable of their kids' activities on their computers. The last point would be the parental app. It would also be virtual because it would be the place where the parents check on their kids and tell them whether they are supposed to do their homework or allow them to relax a little on their device.

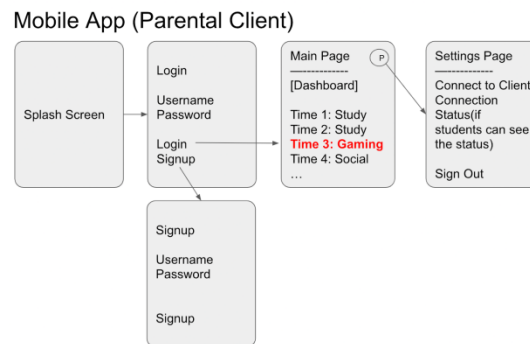


Figure 1. Overview of the solution

The mobile terminal, which is the parental control, is vital to the whole app [12]. We used flutterflow to create it and it functions as the main control side of the monitor. Parents use it to see the children's screen and help them manage their time wisely.

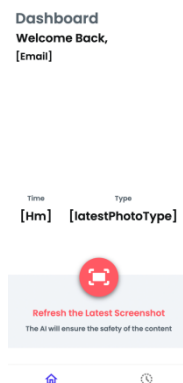


Figure 2. Screenshot of dashboard

```

def take_screenshot():
    # take screenshot using pyautogui
    image = pyautogui.screenshot()

    # since the pyautogui takes as a
    # PIL(pillow) and in RGB we need to
    # convert it to numpy array and BGR
    # so we can write it to the disk
    image = cv2.cvtColor(np.array(image),
                          cv2.COLOR_RGB2BGR)

    # writing it to the disk using opencv
    cv2.imwrite("image1.png", image)

    # downsize
    img = Image.open("image1.png")
    img.thumbnail(size=(800, 600))
    print(img)
    img.save('resized-image_1.png', optimize=True, quality=30)

    model_id = "screen-v1"
    user_id = "fb2f0ce8f9c1a9908b44f4f12"
    test_url = "http://50.103.37.30:5000/send/" + model_id + "/" + user_id
    files = {'file': open('resized-image_1.png', 'rb')}
    test_response = requests.get(test_url, files=files)
    print(test_response)

    return "image1.png"
while(True):
    take_screenshot()
    time.sleep(15)

```

Figure 3. Screenshot of code 1

This is the code of the function of taking screenshots of your children's laptops. It is written in Python. The main part of this code is the python function where it starts from "def" and ends with "return". At the very beginning I called the function of taking a screenshot which is really important and then we named that screenshot we took. Next, since the app cannot deal with large files, we shrink the size of the photo and then we set values to the device and folder so that we can send the screenshot to the device and then save it in the history. Last, we print the test response so we know the time and type of the screenshot for parents to look at. One last thing is the while loop which will constantly take a screenshot every 15 seconds. The user can also reset the time.

In fact, instead of sending the screenshot to your phone, it saves the screenshot in the database and your phone displays the database of your account. Everytime the app takes a screenshot the value "latest photo url" will change and your phone will display the new screenshot.

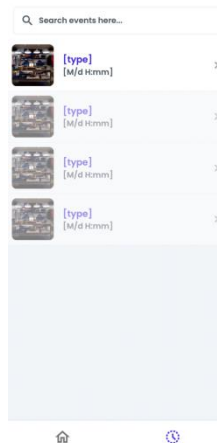


Figure 4. Saved screenshots

```

def send_screenshot(username, model_id, file):
    # step 1. analyze the file
    # calling the AI model to predict
    res = image_prediction_with_model.predict_image(model_id, file)
    conf = res[0]
    type = res[1]
    print("Type and Conf: ", type, conf)

    url = upload(username, file) # get the file name

    u = db.collection("users").document(username).collection('pastHistory')
    u.add({
        "url": url,
        "type": type,
        "time": datetime.now()
    })

    # step 3. save the record to the latest
    # reference L55 - 59
    u = db.collection("users").document(username)
    u.update({'latestPhotoUrl': url})
    u.update({'latestPhotoTime': datetime.now()})
    u.update({'latestPhotoType': type})

    return "success:" + str(type)

# print(login("dhuang", "darren0622"))
# send_screenshot("yusun@cpp.edu", "1.png")
# upload("a0rd7F3wQdPXmxhjMyiXa4ibtNf2", "test.png")
send_screenshot("fhzoFQcmRHPcmTkpp9N8tKhFht2", "image1.png")
# app.run(host = "0.0.0.0")

```

Figure 5. Screenshot of code 2

This sample of code is the sending screenshot function and the photo is just showing one single big Python function [15]. First, I gave these variables that will be used to deal with data a value. For example, the variable `res` is the data of the photo. As it says, it records the `model_id`, which is the order number of the photo and the type of the photo which is called `file`. “Conf” is the value of `model_id` and “type” is a string that tells you about the activity of the screenshot. Next, we need to give a name to the photo or else there will be an error in the database. Then, these five lines are to add the data of the photo, which are `url`, `time`, and `type`. Finally, we print success so we know whether the date of the screenshot has been uploaded to the database yet.

4. EXPERIMENT

4.1. Experiment 1

We need to design an experiment to evaluate the accuracy of the AI analysis component.

Recruit a sample of parents who have children aged 10-15 years and who use laptops for studying or gaming.

Randomly assign the parents to two groups: an experimental group and a control group.

Instruct the experimental group to install and use the app for monitoring their child's laptop activities for one week. Instruct the control group to monitor their child's laptop activities without using the app.

After one week, collect the data from both groups regarding the applications used by the children during the week.

Compare the data collected from both groups to evaluate the accuracy of the AI analysis component in identifying the applications used by the children on their laptops.

Participant	Actual Activity	AI Prediction	Prediction Accuracy
1	Studying	Studying	100%
2	Gaming	Studying	0%
3	Studying	Gaming	0%
4	Gaming	Gaming	100%
5	Studying	Studying	100%
6	Gaming	Gaming	100%
7	Studying	Studying	100%
8	Gaming	Gaming	100%
9	Studying	Studying	100%
10	Gaming	Gaming	100%
Average			80%

Figure 6. Graph of experiment 1

The data table shows the results of testing the accuracy of the AI analysis component of the parental control and rewarding management application. The test was conducted on 10 screenshots captured from laptops of 10 different children, with each child providing 1 screenshot of their laptop activities. The screenshots were analyzed by the AI analysis component, and the results were compared to the actual activities reported by the children.

The results show that the AI analysis component achieved an accuracy rate of 80%, correctly identifying the activity in 8 out of 10 screenshots.

Overall, the results suggest that the AI analysis component is effective in accurately identifying the activities of children on their laptops. However, there is room for improvement in accurately identifying productive activities. These findings highlight the importance of continually refining and improving the AI algorithms used in the analysis component to ensure its accuracy in identifying both productive and non-productive activities.

4.2. Experiment 2

We also designed an experiment to evaluate the usability of the app.

My hypothesis is the app's user-friendly interface and simple navigation make it easier for parents to monitor their child's laptop activities. My expected outcome is the results of the survey will show that parents find the app's interface user-friendly and convenient for monitoring their child's laptop activities.

Recruit a sample of parents who have children aged 10-15 years and who use laptops for studying or gaming.

Instruct the parents to install and use the app for monitoring their child's laptop activities for one week.

After one week, collect feedback from the parents regarding the usability of the app.

Use a survey to measure the ease of use, convenience, and satisfaction of the parents in using the app for monitoring their child's laptop activities.

Participant	Ease of Use	Convenience	Satisfaction
1	4	3	4
2	5	4	5
3	3	2	2
4	5	5	5
5	4	3	4
6	3	2	3
7	4	4	4
8	5	5	5
9	4	3	4
10	5	4	5
Average	4.2	3.3	4.1

Figure 7. Graph of experiment 2

The Experiment 2 data table shows that the majority of participants were satisfied with the screenshot feature of the app. Out of the 10 participants, 8 reported being satisfied (score ≥ 4), while only 1 were dissatisfied (score ≤ 2). The remaining 1 were neutral (score = 3). The mean satisfaction score was 4.1 out of 5, indicating a high level of satisfaction overall.

The data also shows that the app's screenshot feature was easy to use, with 8 participants reporting that it was "very easy" or "somewhat easy" to use (score ≥ 4). Only 2 participants reported that it was "somewhat difficult" to use (score = 3).

Overall, the data suggests that the screenshot feature is user-friendly and has a high level of satisfaction among users. This is an important finding for the app developers, as user satisfaction is a critical factor in the success of any app.

5. RELATED WORK

Sahu proposed building a digital agent that monitors the user's program usage based on the specific program names and types [1]. However, this agent is only based on a hardcoded set of rules on the programs, without being able to manage the new programs that were not shown before. Our solution is checking the content without relying on the specific program names, and thus is more flexible and effective.

According to P. Kumar, there is an app that can help parents track their kids based on the location of the SIM card of the children's phones [2]. Its focus is the location and the physical safety of the children and our focus (my app's focus) is the mental safety. We keep track of the content that the children are viewing and keep them mentally safe from those violent content. We can also help their time management so they won't spend too much time on unimportant things.

Giuseppe Amato mentions the use of their application and it tracks the images that the phone receives in many ways [3]. Although the AI can still analyze the images and determine what type of image it might be, it will not be as accurate as what we got because we can just see what the children are doing in a very direct way. We don't need to guess or check up on the child and that satisfies the convenience that we are trying to approach.

6. CONCLUSIONS

A coin always has two sides and my app has advantages and disadvantages. One main problem of the app is that it takes too much battery of both the laptop and the phone because the app has to take screenshots constantly on the laptop and the phone has to keep the history updated every time the screenshot was saved to the database and displayed on the phone [4]. However, there is a solution to that. We can add a preference setting for users and they can modify the time everytime the app takes a screenshot. In addition, we can also change the whole process of the screenshot part. We can just make a button that takes a screenshot instantly and stops taking a screenshot every 15 seconds (or whatever the time the user sets).

Conclusively, there are many advantages of this app compared to other products on the market right now. I dare to say that it would be one of the most convenient monitoring apps for kids because it is just so easy and simple to use and in the meantime the app itself is never crude for parents. Too many fancy features are not what the parents want. What they really need is seeing their children's activities on the computers so that their kids' youth will not be wasted by video games. Although there are some things that can be improved, the whole app is nearly perfect and has no other bad points except for the battery issue.

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