School Field Trips and Children's Safety

A Teacher Assistant System for School Field Trips

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ABSTRACT

Worldwide school field trips have been an important part of the educational curriculum for young and older students. They are ideally a reinforcement and an extension of the taught curriculum and give the students a more direct, real-world, experience for the theoretical lessons. But for all their benefits, there is also a huge amount of work and stress for the teachers, parents, and school involved [3]. The trade-off between prioritizing safety of the students and the quality of school field trips and the incapability of the current communication devices to enhance security of the children during field trips, led us to the idea of a practical safety-orientated communication system between teachers and students during the field trips and particularly in the critical situations.

According to the process of the user-centered design method [18], several methods were conducted to specify the requirements and expectations of the teachers from an assistant system. Because of the sensitivity of the children's related data, the GDPR guideline [7] has been taken into consideration and to assure the usability of the system a three-level iterative design and evaluation process has been applied. The iterative process included a scenario-based design [21] followed by a parallel design and H-form evaluation [9] and a participatory design (PD) workshop [16] combined with a feedback and discussion session, which led to the final design of the system. "SafeTrip" assists teachers to have better control on the students without restricting their free movements. It also reduces the risks of putting children in danger and anxiety of the teacher by decreasing the amount of the preparation needed.

KEYWORDS

Field trip, teachers, students, safety, user-centered design, usability, critical situation, children, Participatory design

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1 Introduction

In a research study by Falk et al. 96% of 128 subjects could recall a school field trip taken during the early years of their school education and the vast majority recalled when they went, with whom they went, where they went to, and at least three specific aspects of what they did [4]. Although school field trips have been proven to be consequential experiences in children's lives, few elementary school teachers include field trips in their curriculum [7]. One possible reason might be all of the preparation needed. Considering that the teacher must choose a location which is related to the subject of the curriculum, prepare the materials needed and provide the students with a foundation for the trip, give the students some freedom on the trip, but also keep them aligned with the learning goal by providing them with learning material (e.g. worksheets) and also juggle the expectations of parents and the school board [3].

Another big stressor is the "duty of care". Keeping an eye on all students at once is an exhausting task, especially in low visibility, high stressful situations e.g. using public transportation. This also reflects in the guidelines for school trips provided by the ministry of schools and education of the state of North Rhine-Westphalia, which advices having multiple supervisors. Often the schools lack teachers to fulfill these duties completely, then parents or students of age are allowed to take on supervision of some of the children [1].

On the other hand, studies show that teachers feel constrained by administrative procedures and the legal implications of the duty of care [6]. These regulations lead not only to anxiety and over-cautiousness of the teachers but also to the low quality of the school field trips [20]. Therefore, teachers should be able to determine some principles to let the students explore in small groups by themselves but they should still be fast and easily reachable in case of an emergency [1]. However, the supervisors should be aware that letting the children walk around on their own increases the risk of insecurity. Statistics show that young children between 5-14 have the highest risk of being injured or killed as pedestrians [19].

Based on this information we sat the followings as our goal in this project:

1. Reducing teachers' anxiety in highly stressful situations
2. Reducing the risk of humans' error

3. Reducing the restrictions due to the safety issues
4. Narrowing the data collection

For this aim, we started by understanding the context of the use as explained in section 2. Following a user-centered- design, we specified the requirements of the user and iterated the design and evaluation phase 3 times to assure the usability of the system, as explained in section 3. Section 4 provides the conclusion of this study.

2 State of the Art

The basis of this project was fundamental research in the areas of school trips and children's safety as well as the tracking technologies and the GDPR guideline, which will be further explained in the following sub-chapters.

2.1 Children's Safety & Technical Aspect

To give parents and teachers peace of mind multiple inventions tried to create a more secure environment for the children. Shaaban et al. developed a children safety system for the parents, which used RFID[1] technology to track and monitor the children during bus trips [13]. Other startups and researchers also worked in a similar direction trying to make walking around for children safer by giving the parents a mean of control and monitoring. Most of which use a smartphone or a custom device (e.g. bracelet) to track the child and send the location data to the parents [15].

Although this research does not focus on connecting children with their parents the underlying technical requirements are quite similar to the bulk work of the localization will be done via the Global Positioning System (GPS). Since its inception, GPS has come a long way reducing its error from more than 100 meters down to two meters in open spaces and up to 15 meters in narrow streets with up to 4 story building [8]. Because of its abilities, GPS would likely be the backbone of any tracking system currently made.

The biggest drawback of GPS is that it functions on radio waves which can't penetrate larger buildings or underground structures. Although not ideal Bluetooth can be used in these situations to supplement the localization and at least provide relative positioning of the students towards the teacher. This would work by calculating the distance between all the Bluetooth devices and the smartphone of the teacher [14].

2.2 Achieving GDPR Compliance

A big part of basically any system which works with sensitive user data like location, especially, is the data protection. For this reason, the European Union created a new set of regulations known as GDPR (General Data Protection Regulation) which is binding for Services operating in the EU since 25.05.2018. Art 8. Of GDPR states, that for the children younger than 16 years old, the holder of parental responsibility must consent to the extent to which the data shall be processed. To do this the controller (the service provider) must make reasonable efforts, taking the available technology into consideration, to authenticate and verify that the holder of parental responsibility has given the consent [8].

To achieve GDPR compliance in our system, the teacher should be securely identified and verified by using a method similar to POSTIDENT[2] or double-checking with the school board to assure that only the teacher has access to the data. As the school also must have the consent for transferring the duty of care in school trips, the teacher should hand out additional consent forms to the students regarding the assistant system. This would reduce the burden of verifying the consent of the legal guardians while also provides compliance to standards of the GDPR.

2.3 Market Analysis

There are already numerous GPS-tracking devices for the children on the market which are oriented towards assisting the parents. Therefore, they are not focusing on narrowing the functionalities and restrictions on data collections. Moreover, they are mainly designed for giving communication possibility to individual children. To achieve our aim in designing a group-oriented system for school trips with only the necessary features to assist teachers we firstly analyzed the features of the existing products. These include geo-fencing[3], wider range[4], alerts and notifications, panic button, two-way communication, and Games.

To also have an overview of the possible functionalities for the application, we studied and categorized the existing school field trip assistant applications for the teachers as well as the GPS applications for the parents. On the teachers' side, these applications mostly focused on increasing students' engagement (e.g. In the zone [10]) and planning activities for the students (e.g. field trip [5] and Shelburne farm [12]) and on the on parents' side, they are focused on tracking the exact location of the school bus and help them manage their waiting time at pick up and drop locations (e.g. Trackwise [17]). The necessity of each of the existing feature and its functionality was discussed for the users during the first phase of our method.

3 Methodology

In order to develop a target-oriented solution, we applied a user-centered design method [18], starting with specifying users' need and followed by a three-level design and evaluation process to assure the usability.

3.1. Specifying users' need

To represent different types of the users of our system we defined four role-based personas [11] and considered different generations of teachers, with or without field trip experience and different levels of authority for managing a field trip.

[1] Radio Frequency Identification
[2] This method involves sending a POSTIDENT coupon to the subject in question, who must then verify him or herself in the nearest post office with a valid id
[3] This feature allows the parents to set a safety zone
[4] Some of the products can track the children during cross-country visits

After defining different types of users, two semi-structured interviews (recorded with the participants' consent) were carried out with two elementary school teachers who represented the older experienced generation of personas with a high level of authority and provided a holistic view of the preparation process. Both teachers had the experience of losing the students during field trips and supported us in defining the critical situations, including public transportation, where the children can move in freely (e.g. zoo) and if the students have mobile phones (risk of distraction by playing games and taking photos). The teachers mentioned that they could imagine an assistant system with communication possibility, especially if the students can move freely in small groups to be beneficial. Regarding the usability of the system, the following statement was mentioned:

"The significant factor for the usability of the device is that it reduces the complexity, compared to the situation in which students are allowed to have mobile phones." (Interviewee 1)

Both teachers mentioned that bracelet is the most reasonable design for the tracking device because it can be worn easily and the possibility of losing it is low. They also emphasized the necessity of the device to be light, giving the students the possibility to move around freely for longer time periods.

After gaining a general perspective of field trips and the possible problems, we conducted 4 qualitative open-ended surveys with the younger generation of the teachers and teaching students to ask for comments, feedback, and suggestions that aren't as easily classified. Participants were recruited using the convenience sampling combined with the snowball method. The results of the survey provided us with concrete use cases of the system. We could also gain an understanding of the expectations of younger users and digital natives and opinion of having an assistant system.

To address the sensitivity of the research question and reduce the risk of biased information, two observations were conducted in different cities of Germany (one metropolis and one small city). Results showed that as the students usually walk in pairs with holding hands. Therefore, the safety of the group will be easily at risk by mistakes of the leading pair (e.g. moving to the street by mistake). Another important aspect was the intensive reaction of the supervisors due to the frustration in such situations which frightened the students and increased the risk of incidents.

3.2 Design solution and evaluation

In this phase, the iterative design was applied by getting back to the design solution after evaluating it against the user requirements. Three iterations were conducted and followed by a final design of the system:

3.2.1. First iteration

In the first iteration, a scenario was developed and broken down into use cases to let the users imagine the possible situations in which an assistant system can be used. Then, two structured interviews were used to evaluate the scenario. Both teachers found the design solution reasonable:

"The bracelet is a very practical idea, as we used to stick plaster to the students' hands with the telephone number of their parents" (Young generation)

"I find your tracker device useful, cause the students always run out of my sight very fast and I have to look for them over and over again" (Old generation)

3.2.2 Second Iteration

Based on the information gathered in the last stage the first design of the prototype was done by using Photoshop CC. The object of this first prototype was to capture the main essence of what we were trying to do but leaving some questions open to be added and changed in later stages.

As for the tracking device, two different versions of the bracelet (with graphical and non-graphical user interface) were designed based on the parallel design method [2]. The messages between the student and teachers were audio-based and the device needed a microphone and speaker.

As for the application, considering the GDPR, signing up would be a very controlled process, where the identity of the teacher would be verified with school authorities. This main screen includes a large map, on which the teacher is represented as a blue dot and the students as either red, orange or green dots depending on their distance from the teachers.

To evaluate the first version of our prototype an H-form evaluation method was used to enable the participants to record their own views and ideas in an open yet structured way [9]. Our focus was on the evaluation of the balance between privacy concerns and the tracking function of the prototype. Negative arguments of the participants included *"A general weirdness for the students to be tracked all the time"* and *"Monitoring how long and often each student goes to the toilet*". Among the positive reasons were aspect as, *"ability to find lost students quickly"*, *"Peace of mind for the supervisors*" and *"More freedom to students without sacrificing security"*. Using these findings as a basis, the participants discuss possibilities to improve the prototype.

3.2.3 Third iteration

Based on the information gained from the last iteration, the participatory design method was selected for designing the final prototype. Therefore, two teaching students were invited to our lab for a one-hour and a half workshop. To gather specific design ideas the participants were provided with two wooden iPad prototypes, and the design components of the first prototype to be able to work freely with every single element. After the participants designed the screens a feedback session has been held with them. The main findings which have been a) Anonym pointers for each student instead of their name and picture, more information can be shown in critical situations, b) Login with fingerprint, c) Omission of the contact possibility with the parents: as teachers are not allowed to keep the phone numbers of the parents, d) Using alternative communication possibilities to communicate with the lost students, as sending messages is not practical in critical situations.

4 Final design & Conclusion

From the previous evaluation of the first prototype, it became clear that some improvements should be considered. The changes included: A strong reduction of features to simplify the application and increase usability in highly stressful situations, removal of the messaging system between the teacher and the student is especially notable, as the evaluation showed that it would not provide a substantial gain to solve the situation at hand but adds an additional load and complexity to the system and replacement of it with the premade alert messages is a more appropriate solution.

Another feature removed from the previous prototype is the panic button. Because of the concern coming from the experienced teachers that it would be widely misused by students, which could lead to more confusion. Although the panic button could be useful in theory, further experiments on its implementation capacity are needed, to reduce the potential misuse of such its functionality.

To conclude the described system assists teachers on the school field trips, by making the field trip not only more secure for the children but also less stressful and overwhelming for the teachers. By offering tracking functionality, keeping the students closer to each other and alerting the supervisors early if they get far away from the group, not only the safety of the field trips will be increased but also their productivity. Therefore, SafeTrip fights against the traditional belief of the teachers in the existing trade-off between productivity and safety in the context of the field trips. In this regard, SafeTrip can in the long run lead to fundamental developments in the non-productive educational systems, which focuses on the traditional theoretical school settings.

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