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Fearless - Next-Gen Solution for Preventing Sexual Harassment and Physical Violation

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Abstract—In a world where safety is a growing concern, sexual harassment and physical violence have become significant societal concerns. A particularly pressing need for action and reduction in the alarming number of rape cases and violence against women can be seen especially in developing countries, where rape cases and violence against women are on the rise. In order to protect themselves from potential predators and criminals, women must remain vigilant. Developed to empower women during such harrowing incidents, Fearless is a groundbreaking mobile application designed to prevent sexual harassment and physical violence. Using the Google Firebase platform, this innovative application allows users to instantly share their location with trusted contacts to startle potential attackers, share their experiences, or raise awareness. As a result of its interface design principles, Fearless has a highly manageable, user-friendly, and efficient mobile interface. In addition to its compatibility and convenience, it facilitates seamless data management by integrating with NoSQL systems. The system development plan was successfully implemented using the agile process after rigorous comparisons with existing and proposed systems. Fearless emerged as the ideal solution, shaping the entire architectural design. In order to ensure the application's reliability and effectiveness, post-development testing, including black box testing and user acceptance testing, was conducted.

Keywords—Mobile solution, NoSQL system, MVC architectural pattern, Agile Process

I. INTRODUCTION

Sexual harassment [1] encompasses any unwelcome sexual behavior that is offensive, demeaning, or intimidating, whether through explicit or implied sexual innuendos, including the inappropriate promise of rewards in exchange for sexual favors. This misconduct can manifest in various forms, such as written,

verbal, or physical, in-person, and online communication. Acts like unwanted touching, verbal sexual comments, solicitation for sexual acts or favors, lewd stares, suggestive gestures or body movements, sexually explicit jokes, and comments, as well as criminal offenses like obscene phone calls, indecent exposure, or sexual assault, all fall under the umbrella of sexual harassment.

The act of harassment [2] can occur in many different settings and circumstances, including the workplace, the home, school, religious institutions, and public places. The harassment can even occur in the confines of one's own home, perpetrated by individuals near to one. Both harassers and victims may belong to any gender or ethnicity. However, sexual assault carries a more specific definition, although it is related. An act of sexual misconduct occurs when sexual contact or conduct occurs without the consent of the victim and often involves physical violence.

Alarming statistics reveal that approximately 81% of women worldwide have encountered some form of sexual harassment, ranging from rape and physical violence to street harassment and inappropriate touching [3]. This epidemic is escalating, spreading like wildfire. Women, in particular, live in constant fear of sexual assault, enduring derogatory comments about their bodies and attire, unwarranted physical contact, and even violence at the hands of those they know and trust. In Bangladesh, the rape rate has surged, with an average of over four rape cases reported daily, painting a grim picture of the escalating crisis. With the government's response falling short, women must arm themselves with awareness, knowledge, and emergency measures to protect themselves from these dire situations.

II. RELATED WORKS

As of now, there are several existing systems in this world for preventing sexual harassment and physical abuse. Among them are Joy [4], Circle of 6 [5], bSafe [6], and Safecity [7]. As of now, there are several existing systems in this world for preventing sexual harassment and physical abuse. Among them are Joy [4], Circle of 6 [5], bSafe [6], and Safecity [7].

Joy [4] uses a time password (OTP) to register the users. This smartphone application, which aims to combat violence against women and children, includes an emergency button that sends text messages requesting assistance to the local police super and metropolitan deputy police commissioner. Users can also contact their friends and family or call any national help center. This app also has a feature where victims can make a complaint legally to the national helpline with all the information.

Circle of 6 [5] sends prewritten text to friends while also tracking the user's live location. When the user leaves her house, they open up the app. In the event of an assault, users can make a plan of what actions they want to perform by the application. The program delivers a message to six people in the user's circle which is prewritten by the user herself and it also contains the live location of the user.

The bSafe [6] app allows users to select a guardian who can monitor them in different places through live streaming video and GPS tracking while at the same time providing the "follow me home" feature to ensure their safety. In spite of the app's widespread availability, Norwegian and English are the only languages available. It requires a subscription.

As a platform as a service, Safecity [7] assists communities, police agencies, and local governments in preventing violence in public and private settings. In order to uncover patterns and crucial insights, the technological stack collects and analyzes anonymous, crowd-sourced reports of violent crime.

As with the proposed system, all the applications and systems use GPS, WiFi, cell, and SMS technology, which are all similar technologies. Most of the applications require a mobile phone to operate. All applications maintain some common functionalities, but each application maintains its own unique characteristics to maintain its uniqueness by having its own unique features. It is common for the existing system and the proposed system to have the following functionalities: sending SMS messages, a notification system, making calls, or sending photos or videos to seek help. The following technologies are required for the development of Fearless applications: Flutter, Firebase, call, cell, Wi-Fi, GPS, SMS, and alarm.

However, the application for the prevention of sexual harassment is still scarce. Due to the increasing incidences of sexual harassment and physical violation in developing countries, combined with limited government resources, it is imperative to develop and implement a sexual harassment and physical violation application. An application of this type can assist in empowering individuals, raising awareness, assisting them immediately, and contributing to a more secure and safer society.

III. METHODOLOGY

In order to develop mobile solutions effectively, agile methodologies align with the unique challenges and characteristics of the mobile app ecosystem and are therefore appropriate. In addition to promoting flexibility, user-centricity, rapid time-to-market, and a commitment to continuous improvement, it promotes continuous improvement, all of which are essential to success in the rapidly evolving mobile application world.

Agile's flexibility allows developers to adapt and make changes as needed to ensure compatibility with different platforms and devices in the mobile application ecosystem. As user expectations and preferences can rapidly evolve, user feedback is essential when developing mobile applications. Agile allows for continuous user involvement, ensuring that the app aligns with user expectations.

In order to ensure that the preliminary specifications and user requirements are aligned with what the user wants, a requirements-gathering phase was conducted before developing the system. As part of the development, testing, and release of the system, multiple iterations were conducted to develop, test, and release features. As part of testing, validation, and verification were performed to ensure the functionalities were by the expectations of the user and that all functionalities were functioning properly. If the requirements change during the development process, the features of the system will be tweaked again to meet the latest requirements, as shown in Fig. 1.



Fig. 1. Agile Process [8]

A. MVC Architecture

Fearless is developed using the Model View Controller architectural style, which is composed of three main components: Model, View, and Controller. It is the most suitable architectural style to work with Flutter because it is the latest architectural style that is compatible with Flutter. These logical components have specific functions that together make the system work. Flutter already provides all the packages for this architectural style, which makes it convenient since it does not require any extra plugins or custom syntax. Fig. 2 illustrates the system architecture of Fearless.

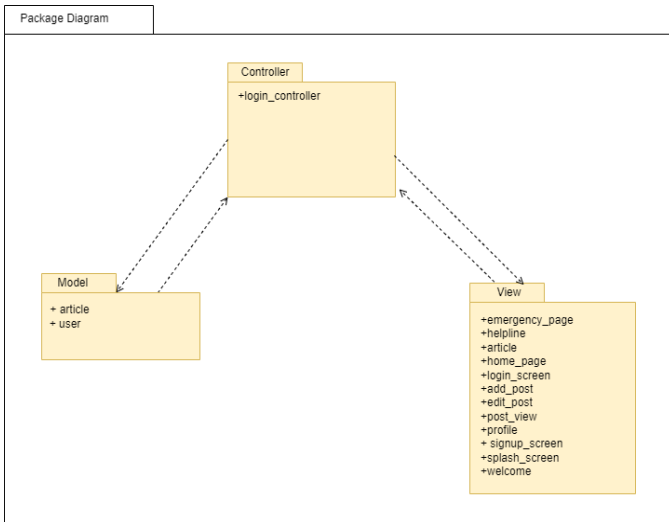


Fig. 2. MVC Architecture of Fearless

A Fearless model is a set of logical components related to user-centric data that the user interacts directly with. It is directly connected to the database, so everything related to data will be reflected in the model. Fearless' view component represents all the screens and interfaces that the user will interact directly with, while the controller component is mainly responsible for connecting the model to the view component.

B. Back-End Development

Using Cloud Firestore and Real-Time Database from Google Firebase as the system database, Fearless did not create any data tables because it is a No-SQL database. However, it contains documents and data collections. Table 1 describes the data for Fearless, which is comprised of two data collections that are interconnected with a primary key.

TABLE 1. DATA DESCRIPTION FOR FEARLESS

Entity	Description
User	A general term that explains all the user data
Article	A general term that explains all the user post details.

The Fearless data is stored in a cloud-based database system known as Firebase, developed by Google. Firebase provides two services for storing the database: Cloud Firestore and Firebase Real-time Database. Firebase Realtime database is a NoSQL cloud database that provides developers with the ability to store and sync data of the relevant system in real-time. All users connected to the database can access the real-time data. User data is stored in Firebase Cloud Firestore whenever a new user registers in an account, and it is updated whenever a user modifies their profile data. In Fearless, Firebase Cloud Firestore implements the CRUD (create, read, update, and delete) system, as well as the possibility of storing user-generated content.

C. Front-End Development

It is based on the Flutter [9] framework and has a single mobile-friendly interface. It maintains the same design principles, resulting in an interactive user interface. With its bold color scheme and easy-to-use icons and symbols, the interface is easy to use for everyone and doesn't require any assistance. In order to maintain the security of the application, the Interface uses a built-in validation system that alerts users to any incorrect input or validates user data. Fig. 3 illustrates the front-end developed for Fearless, which redirects to the device's built-in feature, ensuring the connection between the application and the user's device.

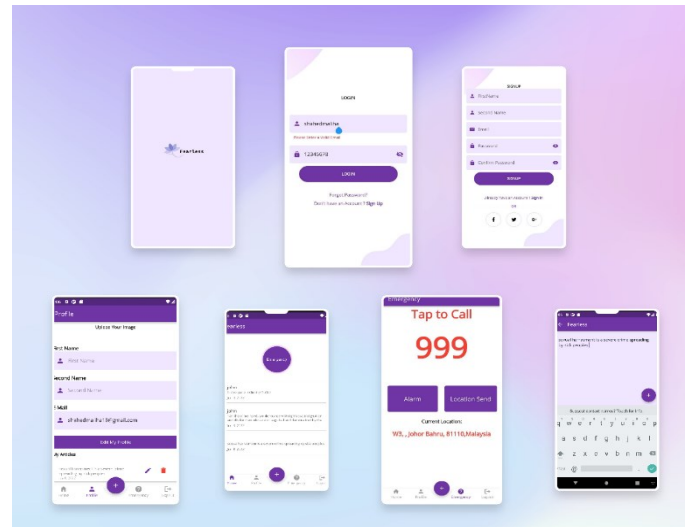


Fig.3 Fearless interfaces

IV. SYSTEM VALIDATION

The Fearless system is validated through three types of testing: functional testing, user acceptance testing, and usability testing

A. Functional Testing

Behavioral testing, also known as black box testing, is used to confirm that each behavioral input leads to an accurate system output. The Black Box Testing process should only target inputs and outputs without regard to Fearless' internal design. As well as facilitating seamless implementation of the system, black box testing also facilitates the detection of any inconsistencies or flaws in functional requirements by the developer. Initially, use cases are used to create test scenarios that include valid or incorrect inputs, execution routes, and expected results. Following the execution of test cases, the actual and expected outputs are compared to find errors. Table 2 presents a sample of Fearless' functional test cases related to the Register function.

a world where everyone can live free from the fear of sexual harassment and physical violation.

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