COVID-Labels: Explainable and Trustworthy Mechanisms for Rebuilding Businesses during the COVID-19 Pandemic

Veronica Sih

Stony Brook University, veronica.sih@stonybrook.edu

Aarathi Prasad

Skidmore College, aprasad@skidmore.edu

Abstract: Businesses, especially ones that require physical interaction, have struggled to stay open during the pandemic due to concerns regarding consumer safety at the business location. We propose COVID-Labels as an explainable and trustworthy strategy to help businesses in communicating real-time COVID-19 infection risks for all stakeholders at the business location.

CCS CONCEPTS • Security and privacy • Human and societal aspects of security and privacy • Usability in security and privacy

Additional Keywords and Phrases: COVID-19, contact tracing apps, pandemic, businesses, privacy

1 INTRODUCTION

The COVID-19 pandemic has affected almost every person around the globe, and it is critical that we continue to adapt to the changes caused by COVID-19. In fact, it is likely we need to prepare for another pandemic due to virus reassortment, as well as an increasing human population that is able to move faster and freer across borders [7,18]. Many businesses have struggled in response to COVID-19, especially ones that require physical interaction [7, 16, 21], leading to rise in unemployment. Businesses need to focus on gaining trust by communicating their vested interest in consumer and employee safety [5, 16]. One way to build trust during the pandemic is to communicate the business' efforts to contain COVID-19 exposure at the business location. Exposure notification smartphone apps were proposed worldwide as the primary digital contact tracing tool to assist citizens and public health authorities in containing COVID-19 [3, 6]. However, people had privacy concerns over these apps about government surveillance [2-4, 6, 8-9, 11-12, 14-15, 22]. Also, these apps were not intended for businesses, so we aim to adapt these apps to help businesses while addressing privacy concerns that may arise among business owners, employees, and consumers.

2 COVID-LABELS

We consider the following design principles while assuming that a significant portion of the population already uses exposure notification apps or other location-based service apps (such as Google Maps, Apple Maps, Doordash, Yelp, etc.) that may incorporate our proposed solution.

- **Privacy for consumers and employees:** Consumers and employees should not have to disclose their location history or their infection and vaccination status to business owners and employers.
- **Utility for consumers and employees:** Consumers and employees need to know how safe it is to enter the business location, which also builds trust in the business.
- **Utility for business owners:** Business owners need to gain the trust of their employees and customers to maintain operations.

We propose COVID-Labels, labels and icons that can be added to existing exposure notification or location-based service apps to communicate real-time infection scores (i.e., the risk of getting infected by the COVID-19 virus) at a particular location. These labels are inspired by the colored QR codes in the Alipay Health Code app, where a green code implied that the smartphone user had a low transmission score (i.e, they had a low risk of transmitting the COVID-19 virus) [23]. Unlike these codes, the COVID-Labels we propose can be used by individuals to gauge their risk of infection at any location (see Figure 1). The risk of infection of person A is computed by aggregating the transmission scores from all the smartphone app users at that location at the time, vaccination status of A herself, and the transmission score of the location [23]. The transmission score of the location must be submitted by the business owner and is computed using factors such as presence of effective ventilation, and periodic cleaning at the business location [23, 26, 27]. The transmission score of a user, computed by their smartphone app, denotes the likelihood of the user transmitting the virus and depends on the degree to which B is immune to the virus. This transmission score also depends on the community's contact rates (i.e., the rate at which an infected person comes into contact with others) and diagnose rates (i.e., the rate at which infected people are diagnosed) [23, 25, 28]. The labels are visible to everyone who is at the location (or wishes to visit it) and has a COVID-Label compatible app, which includes all the three stakeholders, without revealing the identities of the individuals with higher transmission scores, while also building trust given the transparency of the labels.

In this paper, we assume smartphone apps that incorporate COVID-Labels already have a mechanism to compute infection and transmission scores. For example, COSRE estimates an infection score using a birthday-paradox-based probability model to calculate the probability for a person to be exposed to the COVID-19 virus in public places at the county-level [23]. The focus of our paper is instead on the types of labels that are needed to address the privacy and utility considerations of the business stakeholders.

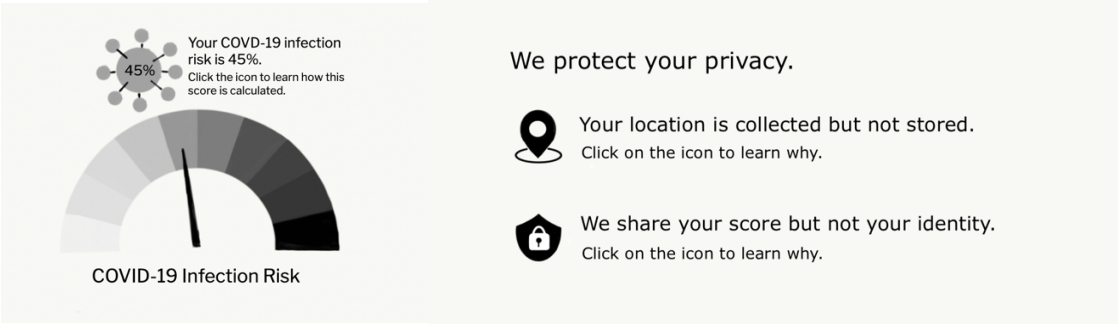

Figure 1: These are COVID-Labels showing an individual's COVID-19 infection risk and how their data is used and shared.

Score labels: By concealing the identity of the people with higher transmission scores, COVID-Labels promote a sense of community, encouraging stakeholders to collaborate in lowering transmission scores at the business location. By revealing the infection scores in real time, consumers can feel safe to visit the business at a time when the infection score is low.

Data usage and sharing labels: Privacy could still be a concern if users are unaware of how the infection score is calculated and how their transmission score is computed and shared. Since all stakeholders see the same dashboard (unlike exposure notification apps), it should be clear that no personally identifying information is shared. Additionally, COVID labels could also incorporate labels to describe data usage and sharing, similar to privacy labels that have been proposed before and are currently in use in browsers and smartphone apps [1, 5, 10, 13]; see Figure 1.

3 DISCUSSION

Often, as part of contact tracing, public health officials release the name of the business and the time when the exposure incident occurred, to the public. Unfortunately, revealing the names of the businesses often led to discrimination against the business and the owners, causing businesses to shut down [2, 17, 19, 24]. By adopting COVID-Labels, businesses can build trust by disclosing infection risk at their location in real-time, similar to COVID-19 pledges about cleaning procedures.

However, for the labels to be trusted, the score calculation needs to be accurate [12]. Further research is needed to continuously update and test the COVID-19 infection and transmission scores to ensure the accuracy of COVID-Labels. Additionally, any code that computes and shares infection and transmission scores should also be secure to prevent malicious actors from accessing or modifying the data.

To increase accuracy of COVID-Labels, businesses might also need consider ways to encourage consumers and employees to share their transmission scores. Businesses can mandate the use of apps that compute transmission scores or provide incentives for employees and customers, such as discounted coupons. Local governments may also assist businesses by providing funds for incentives and also by helping socioeconomically disadvantaged members of the community get access to the devices needed to use COVID-Labels.

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