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# Formal Verification and Implementation for Developing Trust in Ride Share Systems

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**ABSTRACT**

Traffic obstruction, elevated gas prices and insufficient communal transportation are foremost confront for any countryside, trade or entity. The conventional loom to solve this problem is to recover public transportation and use greener power by massive reserves and time. An alternative solution seeks to reduce the number of vehicles on the roads and to travel by making run time or dynamic plans by ride share systems. This system can lead to less consumption of currency, fuel and ecological destructions. One problem that is not focused much in the system is social distress that begins due to deficiency of trust amongst riders and ride givers. In this work we are trying to understand the perception of trust by a model which identifies user's preferences, needs, and travelling behaviors for sharing private vehicles. We formally verified our model and implemented it to reduce three core issues; trust, convenience and incentives. Implementation of the model is provided as a working application. The model identifies trust and dis-trust among trustor and trustee by evaluating human based, ride based and system based trust rating in a feedback criteria. This feedback will help us in identifying trust norms and beliefs to constitute long term societal comfort.
**KEYWORDS:** Trust norms; trust beliefs; societal discomfort; trust ratings; trust expansion; trust contraction.

## 1. INTRODUCTION

Due to great urbanization development in the countries many problems have been emerged in transportation such as road congestion, inadequate availability of vehicles, gas and petrol prices. These traditional approaches need to be changed by redefining looms to focus on better development of transportation. These approaches will help us reducing social discomfort, inconvenience and trust. United States has nearly 4.6 of the world population but it is using 21.8 of the world's energy which became financial crises for the country in 2007 which latterly reduced to 1.2 and 2.2 percent respectively as mentioned in 2006 on website of International Energy Outlook. By using this energy we are producing poisonous emissions which may extent from 29.7 billion metric tons to 33.8 billion metric tons in 2020 as mentioned in 2007 on website of Energy Information Administration. Energy is the urgent demand of production, transportation and inhabited areas in the country. Transportation takes almost 30 percent of the liquid fuel consumption and this consumption can augment from 53 percent to 61 percent in 2035 as mentioned in 2006 on website of International Energy Outlook. Increased claim in delicate travel can be a causative factor which may further amplify the energy consumption.

The mounting ubiquity of mobile Internet technology has shaped new prospects to bring collectively people with related itineraries and time calendar to carve up rides on short-notice [1], [2]. Smart phone technologies has allowed people to share rides where ever and whenever they are on short notices which is named as ad hoc, dynamic, instant and on demand ride sharing [3]. Growing number in travelers per vehicle can be an efficient way to use four seats of a vehicle. This may reduce the problem of empty seats travelling, traffic congestion, petroleum consumption and smog on the roads in case of personal vehicle use. Newly many companies are offering dynamic ride share services such as; Carticipate, EnergeticX/Zebigo, Avego, and Piggyback [4]. These services are connected via smart phone applications and connect to people who want a ride. Conventionally, the person who is offering a ride is known as ride giver and the person who wants to have a ride is known as rider or ride taker.

Despite the fact that we are discussing that ride share promises less travel time, fuel consumption, traffic congestion, pollution etc, we have not focused on the safety improvements yet. Mobility and security should be

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empowered for lower income travelers [5]. Additional features such as profile sharing and rating criteria's should be provided to improve rider and ride givers experience. Rating is considered important because it may help in the progress of the ride share systems and trusting attitude of people to use this system in future. Rating is done to view the driving skills of ride giver, behavior of rider inside the ride, environment in the ride and communication between passengers travelling in the ride. Riders and ride givers have no social relationship with each other and they are totally strangers to each other. This is the reason that permanent and consistent rating evaluation criteria must be developed which will help the riders and ride givers to travel easily in the future. In the other case system will be a total social discomfort and inconvenience for the people in terms of trusting a person who is totally unknown for them.

Although, trust is a very personal perception of an individual [6]. Trust is the self-assurance as the extent to which one is willing to credit good intentions to and have confidence in the words and actions of other people [7]. Trust has also been defined in stipulations of expectedness; both together trim down vagueness [8]. People have their inclination in trusting another personage. Familiarity has been a well thought-out clause for trust [9]. For example, a stranger is considered less trustworthy than parents [8]. People lean to trust their family members, friends and associates more to establish communal confidence compared to others [10]. Trust plays a major role in launching collaboration for humanity to work fruitfully [10]. Social relationships and trust play an important role in many supportive accomplishments. Web based social arrangements also commonly known as social network sites have subjugated this theory by integrating social preferences and trust, as mentioned in 2006 on website of International Energy Outlook. Facebook, twitter, whats app and viber are the main social networking cites. Facebook has 400 million users and more than 100 million active users who are connected on their mobiles on a simple go, as mentioned in Press Room of Facebook blog. It may help in finding social relationships such as friends, friends of friends, associates, relatives, colleagues, class mates, university members and so and so either directly or indirectly. On the same, several web based ride share applications like Goloco (2013), Zimride (2012), Nuride (2011) and Loopt (2005)exist today that help individuals to plan and share rides.

The problem lies when we try to identify trust in terms of trust rating as an independent system. Instead of relating people by some recommendation system, we should claim for some independent system where no one is dependent to the other because of having a fair display of his/her rating in the profile. The trust values should be computed on users' preferences which are known as human based trust factors. These human based trust factors should be sub divided into further levels such as system and ride factors of trust. In a system like ride share we should integrate some additional factors such as flexibility and dependability of the system in terms of trust evaluations of human factors. These evaluations will lead us to formation of trust norms. Trust beliefs are the learning behaviors from existing experiences which may further help to constitute trust norms [11]. The beliefs and norms are developed by attaining positive or negative perception toward trust.

Social discomfort arises in the system when there happens lack of trust between riders and ride givers individual negative ratings [12]. People want to choose the persons whom they are going to travel to reduce the problem of strangers menace. We need to develop a system in which users prefer to learn in choosing the co-passenger by seeing their personal profile rating reviews. There seems a lack of motivation and incentive for the people top share rides with security. There is a need to understand the travel habits of people for variety of their preferences. A system can be made successful when it fulfills the demands of people satisfaction (protection and trust supervision). We should create a rating methodology by which we can comprehend the normally happening needs of people, from which we can realize the societal comforts for the community. By adopting these criteria's we can implement ride share as a public transport.

Specifically, our system is focusing five phases, formal verification and implementation of i) new member ship and trust decay scenarios in the system, ii) assessing human based trust factors, iii) by mingling system based trust factors, iv) in means of ride based trust factors v) estimating trust & vi) constructing trust norms and beliefs. State of the art explains that we are focusing to accumulate a trust model which will have properties of human trust constraints and forces the availability of user preferences to make the ride share system successful in terms of trust and security completion. Casing up the debate, modeling of trust factors will help us in pronouncement making scenarios. Our work diverges from others because we are focusing on shared plans and extended societal norms which are based on dynamic belongings. Dynamic properties include changing preferences, daily routines and habits which include time, fuel, cognitive costs and travel behaviors in terms of human beliefs.

The rest of the article is organized as follows. Section 2 presents the back ground, describes related work and contribution toward research. Section 3 presents the methodology and approach. Section 4 explains the model design and its formal verification. Section 5 presents the real world implementation of the system. Section 6 summarizes the paper and discusses future work.

## 2. RELATED WORK

Ride share is a scheme which is based on private cars known as carpooling or recurring system. It has been studied from past few years for routine substitute e.g. from home to work [13]-[15]. Recently, it became gradually tricky for people to hail cars through rush hours in increasing swarming metropolitan areas. As expected, ride share [16] is considered as a prospective approach to undertake this rising transportation annoyance. Due to dynamic status of cars, any user can submit a query anytime and anywhere and ride is constantly moving (picking up and dropping riders). Due to this fact there must be some familiarity, mutual dependence and certainty in the ride. Trust, faithfulness, flexibility and collaboration are key factors that should be maintained in a ride other than strict arrivals and departures.

While, trust is individuals' perception, we can say that A trusts B but B do not trust in A as a rider. These terms and conditions of trust cannot be defined generally. Trust is not a transitive belonging i.e. A trusts B, B trusts C and eventually A trusts C. This property always does not stand true. We can assume that A can rely on his trust in B to trust C [17]. This type of transitivity is referred as conditioned transitivity. Different trust models are defined according to their own defining characteristics [5]. Generally, deciding a doctor for check up means checking for his expertise, his duration of experience and common reviews from people about him. Same things are considered while developing a trust model to meet its satisfaction level.

Trust is a procession of connection between two individuals which may be degraded as the procession increases. [18] discusses trust in direct system of connection which is evaluated by ratings and assessment count. To distinguish trust value between two people, trust and dis- trust ratings are considered. It shows that if two people have satisfactory amount of trust in the ride and they trust each other for next rides too, it does not mean that a friend or friend of a friend can find the same experience by trusting the two parties (who already trust each other). It means that degradation occurs when we try to increase the connection of procession. Experience of one cannot be the same for other.

We can say that trust is not bidirectional. If A trusts B, it does not mean that B trusts A. But we can presuppose that trust is mutually reliant to some extent of differentiation [19]. If there exists only one directional trust then the system may lead to deception because co-operation will fail and co-operation demands equivalent trust in both the directions [20].

It can easily be explained by trust values that how much a person trusts other. It can be understood to some extent when trust is degraded to certain level as described in [17]. It describes different levels of trust to show alliance between each level. Dis-trust is meant for negative trust. The importance of dis-trust is clearly explained in [18]. It shows that some time negative rating or feedback can be more important in making decisions despite of positive experiences. Different values of trust and dis-trust even cannot explain the relationship between two people. However a feedback system may be useful for noticing and evaluating the likes and dis likes of peoples preferences and relations [21]. Feedback collection is the affordances of one toward trust or dis-trust which can be further used to filter the required information [22]. In ride share application, feedback method can be used to evaluate the ride experience between different trust or and trustees.

Recommendation system can be important in judgment of trust [17]. It can be exemplified as; if A trusts B and B recommends a friend C to A and A agrees to trust C on the recommendation of B. This system is usually used in social networks in which you can recommend people you already know. This can be interesting when a complete stranger is been recommended in the system. What would be the trust value to him will be allotted. To launch trust between riders and ride givers, a suitable model is requisite which should deem various factors such as likeness, behavioral and communicative association, social affiliation in a social network grid and affordances to accepting or rejection in the system. Recommendation attained from identified source is much consistent than strangers but they do not seem perfect in the sense of sharing a ride with someone. Preferences fluctuate from one individual to another based on different circumstances, across masculinity, background. A profoundly research is desired to the structure in which a model should independently deal with the ratings to trust a person or not.

The existing ride share systems have many dead ends to be improved. To complete the incompleteness we could contribute as:

i. In contrast to [17], we explored experience count and common reviews to better judge the trust of one rider or ride giver.
ii. By using degradation methods [18], we evaluated trust and dis- trust by assessment scores and ratings.
iii. Instead of [20], Freedom is given to users in our model to choose their preferences consequently.
iv. By clearly identifying trust and dis-trust [18], we assumed positive and negative trust values in the model for decision making scenarios toward a ride.
v. By voting system explained in [22], feedback method is used to evaluate the ride experiences.

vi. As described in [17], recommendation system is developed which shows that recommendation from a known source is not considered reliable and some independent trusting system should be formalized.

Rideshare system looks like a reasonably simple idea, it is not so, and therefore not used broadly. There are three major motives why these systems have not expanded many users in the history. First, there is structure level complexity in setting up a ride; it occupies huge planning and involvedness. Second, there is communal discomfort that arises due to need of trust amongst co-passengers. It revolves out that trust in co-passengers is the most significant aspect why people are not enthusiastic to give or take rides from others. We cultured that users prefer to choose their co-passenger. Lastly, there seems to be lack of enticement or inspiration for people to share rides. In this research we are trying to point out perceptions of trust of different riders and ride givers to make a mutual system of ride sharing. Riders and ride givers experience can improve the insight and understanding of trust in this domain.

## 3. RESEARCH METHODOLOGY

Whenever we are going to verify and implement our model, there must be some things which should be confirmed earlier e.g.

i. What will be the architecture of "Trust Reputation Model"?
ii. What will be the method to verify the design of Trust Reputation Model?
iii. What type of techniques and tests we are going to use in the model for verification?
iv. How the system will be identified as a working application.

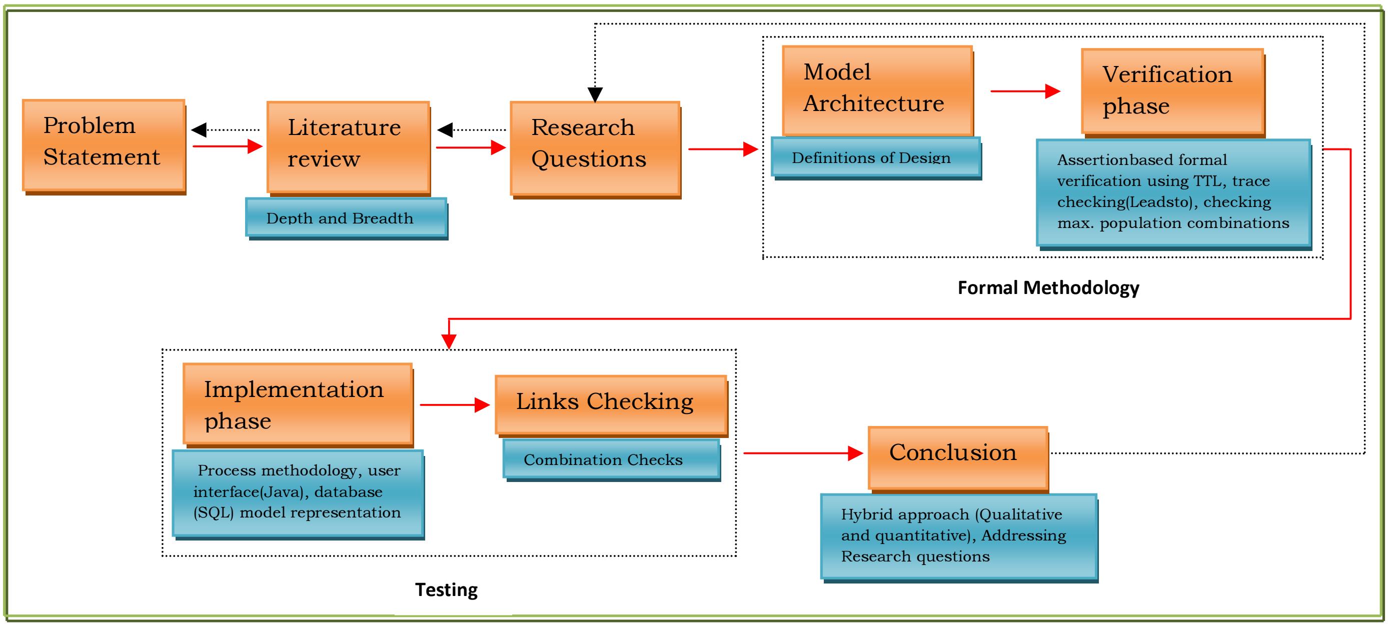
The term model design means that it's a technique for automatically verifying correctness properties of finite-state systems. Model designing refers to exhaustively and automatically checking whether this model meets a given specification or not. Some safety requirements of the model are being judged such as absence of deadlocks and similar critical states that can cause the system to crash. Model is checked for the cause that whether a given structure satisfies a given logic formulae or not. A simple model checking problem is verifying that a formula in the propositional logic is satisfied by a given a structure.

Verification of model can include many testing techniques such as white box, black box, static, white paper, box, alert box, white board, check box, dialog box testing etc. Some of these techniques follow input stream and some follow output streams to focus toward the model verification. Likewise in the previous model validation we logically provided the formulas of temporal logic and now it's the term to formally verify them. So, by defining the methodology we have focused on output or the goal of the system and inputs were known to us. For having the considerations of safe ride we have to verify the inputs that greater the rating greater will be trust for accuring a safe ride. It shows that our focus will be on the black box testing. In black box testing tester only knows the inputs and outcomes are generated by these inputs and are not previously assured. Black box testing is unbiased because every entity is individual. No specific programming languages are required and test is done from the point of view of user, not the designer. But there might e a problem that testing every input stream might be time taking.

A predicate logic named as TTL (Temporal Trace Language) is best suited for analysis of dynamic properties in alternate of differential equation [23]. This language is best suited for both qualitative and quantitative aspects. It provides specification and analysis of dynamic properties which no other language provides either because this language is highly expressive. It provides normal forms to enable automated analysis, while TTL provides support system behavior at different levels of abstraction. It assures state properties in ontologies and dynamic properties are expressed in terms of time, state, trace, state property, value etc [23], [24]. TTL provides modeling of continuous systems. In contrast to differential equation which provides solutions in discrete or dense frames, the traces of TTL satisfy the dynamic property of differential equation because differential equation is less expressive, logics are not sufficient to describe complex distributed algorithms [24]. Large number of equations and parameters are required which are difficult to analyze mathematically and computationally. Other modeling techniques have limitations of expressivity which compromise the feasibility of system in different domains. Expressivity of languages is limited to the possibility of effectiveness and efficient analysis of models.

Implementation of the system is provided by using the programming language Java in eclipse editor and databases are maintained in SQL server. Where, all the model design and architecture is applied as a working application to show the applicability of the system. The overall research methodology of the system is identified in Figure 1:

**Figure 1: Research Methodology**

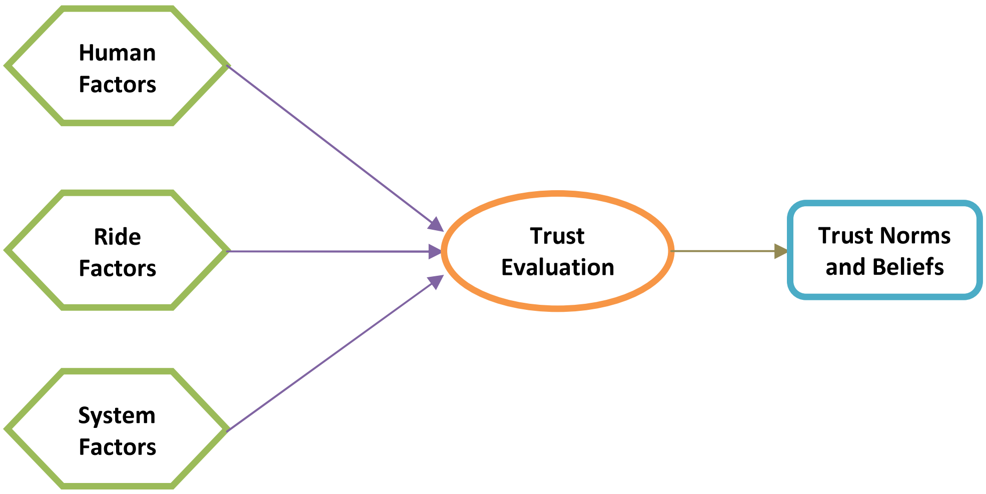



## 4. VERIFICATION OF MODEL

When a rider interacts to dynamic environment, TTL provides an input and output state to the rider or ride giver. Consequently, the input states are the observations to the environment and output states are actions to the environment. TTL provides the definition of relationship between each participant. Likewise many of the processes of our model can be easily verified by TTL including monotonocity progressions, safety encounters between respondents, option creation for ride, successful rides etc. The validity of model can be directly traced by verification formulas. TTL provides an editor to back track the formulas.

Furthermore, we need to verify each step of the model which will identify that the inputs may lead to safe ride as an output or not and what may be the learning outputs.

**Figure 2: Model architecture for trust construction**



***4.1 Verification of trust decay:***

Whenever, a user (ride, ride giver) gets decay function means he/she is not using the service for some reasons which will affect the actual trust rating. If a person wants to have or give a ride after some limited extended time then his current rating is detained from the previous rating. While, r1 is the current position of rating and r2 is the previous position of rating, where ≡ shows instantiation of an identical process,⇒ points or implies to a state, $\gamma$ a trace, ∀for all instances, ∃ for existential states,∈ for belongs to, $T$for instance in a time, ¬ for negation, & for continuation of a state and⊨ for predicate symbol.

$$T1(expired\_time_{period}, rider, ride, trustrating) \equiv$$
$$\forall\gamma: trace, expired_{time_{period}}, r1, r2: time, a(rider): trustee$$
$$decay\_in\_trust\_rating(\gamma, a,)$$
$$(r1 - r2) \Rightarrow expired\_time_{period} \tag{1}$$
$$\forall\gamma\forall t1[(holds(state\ (\gamma, t1), observed_{rating}(trustdecay)) \Rightarrow$$
$$\exists r1 > r2 |\ r1 < r2\ holds\left(state(\gamma, t1), obtained_{rating(actual_{rating})}\right)]$$
$$\Rightarrow selected(\gamma, a, ride, trustrating, expired\_time_{period}) \tag{2}$$

***4.2 Verification of new membership:***

Whenever a person is intruding newly into the system, he/she might initiate his trust rating from zero and this will have its further ratings onward.

$$T1\left(new_{membership}, rider, ride, trustrating\right)$$
$$\forall\gamma: trace, ride(r), r1: time, a(rider): trustee$$
$$entering\_a\_system(\gamma, a, r)$$
$$r1 = 0 \Rightarrow for\_new\_membership \tag{3}$$
$$\forall\gamma\forall t1[(holds(state\ (\gamma, t1), observed_{rating}(for\_ride)) \Rightarrow$$
$$\exists r1 = 0(\ holds\left(state(\gamma, t1), obtained_{rating}(new_{membership})\right)]$$
$$\Rightarrow selected(\gamma, a, ride, trustrating, new_{membership}) \tag{4}$$

***4.3 Verification of Human Trust factors:***

Trust factors include human factors and it is the perception of rider or ride giver that he may want to have a ride or not. This depends on the perception of preferences i.e. a rider or ride giver may not be satisfied because his preferences in the ride are not fulfilled or there is some negative experience that is influencing the people not to take the ride. But on the vice versa if preferences are fulfilled and positive experiences are retrieved, the person will willingly try to have the ride. We can verify it as:

For perfect match of preferences:

$$\mathrm{T1}(\ \mathrm{pos_{exp}}, \mathrm{user_1}, \mathrm{user_2}, \mathrm{promised_{state}}, \mathrm{fullfiled_{state}}, \mathrm{trust_{factors}}) \equiv$$
$$\forall\gamma: trace, ride(r), a(rider): trustee$$
$$[rider \in ride, r \Rightarrow promised_{state} \&$$
$$absolute\_pos\_\mathrm{exp}\quad(\gamma, a, r) \Rightarrow$$
$$fullfiled_{state}(\gamma, a, pos\_\mathrm{exp}, \mathrm{promised_{state}}, \mathrm{fullfiled_{state}},$$
$$trust_{factors}) \tag{5}$$

If the perfect match of preferences has not been done then there follows compromised state which is the total decision of rider or ride giver for the sake of reaching the destination.

$$\mathrm{T1}(\ \mathrm{ridetime}_{period}, \mathrm{compromised_{state}}, \mathrm{trust_{factors}}) \equiv$$
$$\forall\gamma: trace, ride(r), rider(r), a(rider): trustee$$
$$[rider \in ride, r \Rightarrow \neg promised_{state} \&$$
$$absolute_{neg_{\mathrm{exp}}\ \ (\gamma,a,r)} \Rightarrow$$
$$compromised_{state}(\gamma, a, neg_{\mathrm{exp}}, \mathrm{compromised_{state}}, promised_{state}, trust_{factors}) \tag{6}$$

Where:

$$absolute\_negative\_experiences(\gamma: TRACE, a: TRUSTEE,$$
$$tstart: TIME, tend: TIME)\ \equiv$$
$$\forall t: TIME, r1: R, a: TRUSTEE$$
$$[\ t \geq tstart \& t < tend \& state(\gamma, t)\ \vDash \mathrm{trustee\_wants\_}promised_{state}(a, r1)\ \&$$
$$state(r, t) \vDash trustee\_got\_comrpomised_{state}(a, r1)\ ] \tag{7}$$

***4.4 Verification of system factors:***

System factors depict from the model that if the trust updates positively then we will have positive trust progressions which will lead a healthy ride and vice versa. Formal verification explains that if trustee always gets positive experiences by all his previous rides then the system will develop a constant behavior toward the ride and positive monotonic progression is held which will increase the trust rating and a long term relation is maintained. It can be seen as:

$\exists t \exists a: trustee \exists l: ride, trusted_{ride}, compromised_{ride},$
$\exists e: pos\_exp, neg\_exp$
$state(\gamma, t) \vDash always\_a\_ride(a, l, e)$ (8)
$state(\gamma, t) \vDash gives\_pos\_\text{exp}(l)\&$
$state(\gamma, t) \vDash system\_performes(a, trusted\_ride)$ (9)
$state(\gamma, t) \vDash gives\_neg\_exp\ (l)\ \&$
$state(\gamma, t) \vDash system\_performes(a, compromised\_ride)$ (10)

***4.5 Verification of ride factors:***

Verification includes ride factors as attitude toward ride which may change with the effects of external factors and situational decisions or may remain the same having no effects.

$\text{T1}(\ \text{pos}_{\text{exp}}, \text{neg\_ exp}, \text{ride}_{\text{attitude}}, \text{factors(f)}) \equiv$
$\forall \gamma: trace, ride(r), pos_{\text{exp}(p)}, neg_{\text{exp}(n)}, a(rider): trustee$
$state(\gamma, t) \vDash system\_performes(change\_in\_factors(f))$ (11)
$state(\gamma, t) \vDash gives\_pos\_exp(p) \Rightarrow$
$absolute\_pos\_\ \text{exp}\quad (\gamma, a, r)\&$
$state(\gamma, t) \vDash gives\_neg\_\text{exp}(n) \Rightarrow$
$absolute\_neg\_\ \text{exp}\quad (\gamma, a, r)$ (12)
$ride_{attitude}(\gamma, a, r, factors, neg_{attitude}, pos_{attitude})$ (13)

***4.6 Trust evaluation:***

Trust evaluation is done by using relative trust. If some experiences are providing a good rating but the other observations do not provide a good rating then how the trust drop_ out will occur and how the trust will be measured against it. For this reason we can have two intervals such as [t1, t1,interval_length] and [t2, t2, interval_length]. It can be formally analyzed as: $M(interval\_length: DURATION, \min\_difference: REAL,$
$max\_time: DURATION)\ \equiv$
$\forall \gamma: TRACE, t1, t2, tstart, tend: TIME, a: TRUSTEE$

Where

$experience\_sequence(\gamma: TRACE, a: TRUSTEE, t1: TIME, x: DURATION)\ \equiv$
$\forall y: DURATION\ [\ y \geq\ 0\ \&\ y\ < x\ \&\exists r: Ride$
$[\ state(\gamma, t1\ +\ y) \vDash trustee\_gives\_pos\_experience(\gamma, a, r)\ \&$
$state(\gamma, t1) \vDash system\_obtains(a, pos\_trust\_value)$ (14)
$state(\gamma, t1\ +\ y)\ \vDash trustee\_gives\_neg\_exp(\gamma, a, r)\ \&\ ]$
$state(\gamma, t1) \vDash system\_obtains(a, neg\_trust\_value)$ (15)

***4.7 Trust Norms and Beliefs:***

In any trace $\gamma$, if a bad experience occur from trust evaluation or by system factors, it may happen at different time points the system will contract or collapse or we can say that system will learn that it is the behavior other than positive consistency of trust. Same will be the case for positivity in the trust and will be responded as high_trust in maximum iterations and will lead toward the expansion of trust. It can be formally analyzed as:

If the norm exists that we have more positive attitudes toward ride, that norm will lead us to a belief of system expansion.

$\forall t\ \ [\ state(\gamma, t) \vDash high\_rating\&$
$\exists t1, t2, t3, t4, t5, t6$
$t1 < t2\ \&t2 < t3\ \&t3 < t4\ \&t4 < t5\ \&t5 < t6\ \&t6 < t\&$
$[state(\gamma, t1)\ \vDash high\_rating\&state(\gamma, t2)\ \vDash high\_trust\&$
$state(\gamma, t3)\ \vDash high\_rating\&state(\gamma, t4)\ \vDash high\_trust\&$
$state(\gamma, t5)\ \vDash high\_rating\&state(\gamma, t6)\ \vDash high\_trust\ ]$
$\Rightarrow \exists t7\ \ t7 \geq t\&state(\gamma, t7)\ \vDash expansion$ (16)

If the norm exists that we have more negative attitudes toward ride, that norm will lead us to a belief of system contraction.

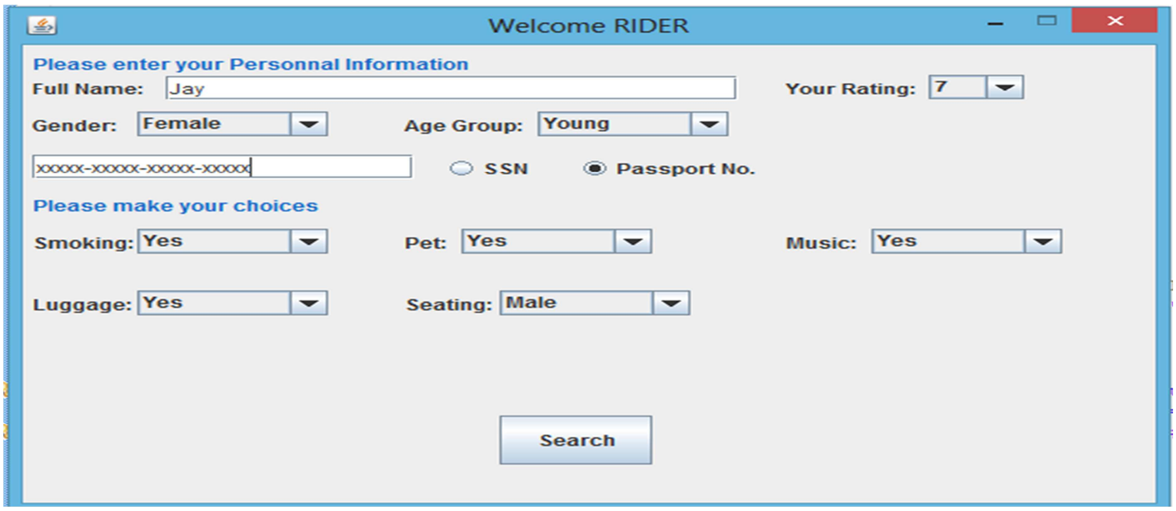
$$\begin{aligned}
&\forall t\ \ [\,state(\gamma,t) \vDash low_rating\&\\
&\exists t1, t2, t3, t4, t5, t6\\
&t1 < t2\ \&t2 < t3\ \&t3 < t4\ \&t4 < t5\ \&t5 < t6\ \&t6 < t\&\\
&[state(\gamma,t1)\ \vDash low_rating\&state(\gamma,t2)\ \vDash low_trust\&\\
&state(\gamma,t3)\ \vDash low_rating\&state(\gamma,t4)\ \vDash low_trust\&\\
&state(\gamma,t5)\ \vDash low_rating\&state(\gamma,t6)\ \vDash low_trust\,]\\
&\Rightarrow \exists t7\ \ \ t7 \geq t\&state(\gamma,t7)\ \vDash contraction
\end{aligned} \tag{17}$$

## 5. IMPLEMENTATION:

When we talk about implementation of a system, we mean that there is a working prototype which can work in a real world. Implementation of the working application is demonstrated from model design and trust model. The scenario depends on three phases' human factors, ride factors and system factors. First of all the preference of the ride taker is filled. Afterwards he is matched with his related ride givers and ride givers also seem to select the rider on the basis of ratings. Ride factors will include the external or situational decisions which can happen in the ride. System factors will help to update or degrade trust value of a person by feedback system. Afterwards all the trust ratings are stored are in the database of related rider or ride giver which will show the constitution of trust norms and beliefs after instantiation of many experiences.

So when we talk about rider and ride giver we have to build all their information's in data bases. Where all the values of ratings, their preference rides, are updated over there. When we see the ride share console. There is a form where every time users select their preferences and provide their information for validation of their identity which is illustrated in Figure 3.

**Figure 3: User preference form.**




This console shows the working of human factors where all the facilitating conditions should be fulfilled. There may be two options that a ride may not be matched and user should compromise on some of his/her preferences. In this situation the form again appears so that user may accommodate some of his preferences. This dealing refers toward ride factors where situational normalities and indifferent conditions can change the decision and interaction or perception may change.

Afterwards, there may happen the condition in which some ride giver is matched. In this scenario the ride giver and ride taker both decide that they have to initiate the ride or not by evaluating the rating sequence on the profile of each user. There may be a condition in which two or more than two ride givers are matched according to the preferences of rider. In this condition the rider prefers to see the rating of each user to select his ride giver. In this case, the person with maximum rating might be selected. Afterwards, there comes the situation in which ride giver selects whether he wants to move with the rider by assuming his profile rating. If both the rider and ride giver are selected then there comes system factors in which rider gives feed back to ride giver and vice versa. This system manages the experience count and trust update. It is explained in Figure 4(a) & 4(b):

**Figure 4(a): Feedback System**

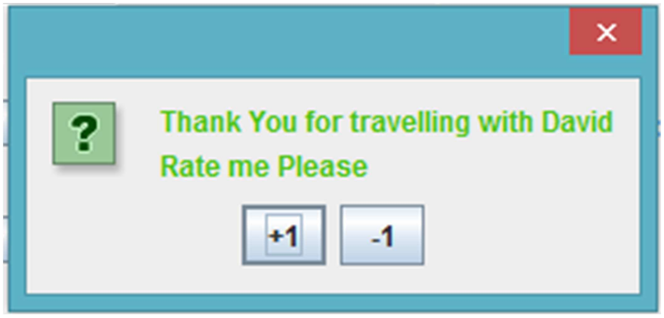



**Figure 4(b): Feedback System**


All the ratings are saved in the data base with the expansion or contraction rate whatever it may be. Such ratings constitute to form negative or positive progressions which help to maintain trusting intentions for developing norms of a society. Conclusion of the description shows us that the system we have verified formally can be simply implemented in to a working prototype which shows the fulfillment of human factors, their preferences, identity validation for the sake of reducing stranger danger, system factors for explaining the trust update by providing the rating of each entity in the system, ride factors which may include some situational or external decisions in the form of no matches found or more than one match found, trust evaluation in the form of feedback system which is provided to each user at the end of ride and construction of trust norms and beliefs after the feedbacks are stored to database after the occurrence of each ride.

## 6. CONCLUSION AND FUTURE WORK:

In this article, we have presented a model and its formal verification in terms of rating reviews to view trusted transport system as a societal comfort and a source of good norm. These norms and beliefs can enhance the recommendation system in the society. We concluded three significant factors which people can regard while contributing in ride share system- handiness, trust and inspiration.

Trust is an important factor which verifies how contented people are in the internal customization of a ride. Riders and ride giver's willingness to participate in the ride is equally comparative to the level of trust in co-passengers. Friends, friends of friends, relatives, and shared local society are trusted alternative to share a ride but there was a need to connect the people who are unknown to the system. If the people having no social connections were rejected then the motivation and charm of the system was reduced. We proposed trust model to deal in the scenarios when we have strangers travelling with us because fifty percent times we do travel with unknown people who are relatively a distant community to us. By this scheme we can have maximum number of promising members in ride share agenda. Our model reveals a dynamic design of a ride share system that concentrates on the question of communal anxiety and convenience of ride share plan. It is obvious that social arrangement articulate trust in direct and indirect appearance. We used such ties for designing the model to leverage and embed trust in it for designing ride share system. Our model is made up of many factors such as human factors, ride factors, system factors and trust evaluations to these factors are constituted by ride ratings, recommendation systems, feedback systems, expertise and fellow feeling. This model can be used in other trust forming mechanisms. Depending on the domain of application, some factors may be intermingled or trust preferences may be blended together.

Our aim is to implant trust in ride share programs. Trust can only be implanted when we are able to understand its versatile sense. This research reveals that any collaborated application needs understanding of diverse characteristics of trust insight. A ride share trust model can also help a rider meet and assess new people and ride experience to develop a consistent behavioral norm that would be considered in future to have practice of safe rides. Trust norms and beliefs are the goodness of measures which are developed to perceive the trusted environment. This develops a sense of integrity of system in the society in which one feels comfortable toward acceptation or rejection of the system in our society. Willingness to trust can be developed by the benevolence to trust and getting intentions or willingness to trusting a norm in the society. Trust toward a system or norm in the society is developed when all the facilitating conditions and situational normality's are fulfilled in some indifferent environments. Such decisions or outcomes can decide the future experience in any society.

Supremely, our system will be able to post and view ride experience through feedback in ratings. Lastly, we will be capable to present encouragement and enthusiasm to people to believe ride share as a good substitute to their private medium. Inducement can be economic, ecological or merely a expediency in setting up rides.

In the future, we would like to develop a consistent recommendation system in which people who knows each other can recommend them for other rides too. We will try to tackle the social debate of psychological problems of behavior in which one try to reduce the rating of other or oppose him or tries to give others dire ratings. This will help riders and ride givers to know more about distant communities and strangers to remove any hesitation linked with driving ability and behaviors. An additional useful augmentation would be exhibiting the total number of people who nominated for a particular ride. Entire of information will assist to conclude a rider or ride giver's driving ability and how active they have been in contributing and accommodating rides for developing long term social beliefs.

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