Bap re Bap! Driving Experiences through Multimodal Unruly Traffic on Bumpy Roads

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ABSTRACT

Congestion, lack of compliance to traffic laws, multimodal traffic, opportunistic decision making and poor road conditions are few of the key challenges faced by drivers in a developing country's metropolitan city such as, Dhaka, Bangladesh. The driver's experience is affected by such road conditions which in turn shapes up their driving behavior and thus affects the traffic conditions which has been studied using sensor enabled tools as well as qualitative methods from a developing country's context.

Categories and Subject Descriptors

H5.m [**Information Interfaces and presentation**]: Miscellaneous

General Terms

Human Factors, Experimentation, Measurement

Keywords

Developing Country; Measurement of Driver Experiences; Multimodal Traffic; Dhaka Traffic

1. INTRODUCTION

Bap re Bap! is a commonly used expression in Bengali which closely matches to the expression *Oh my goodness!* to illustrate the driver experiences in Dhaka, Bangladesh, a city of more than 14 million people, severe traffic congestion and poor road conditions.

Our challenges had many dimensions as depicted in Figure 1-(a) and (b). From the traffic viewpoint, we have multimodal traffic (*heterogeneous*)- vehicles with various speeds. Various vehicle driversdiffer in their education level and knowledge on traffic rules [5] as well as roadside safety. The fact that traffic rules are very often violated, both by the drivers and the pedestrians, make the situation more complex. Moreover, heavy traffic situation exacerbates due to the poor road conditions across the city [6]. The combination of these factors puts the driver in a unique position and we want to portray the driver experiences. We define **Driving Experience** [1]. A bad driving experience can have a profound effect on his/her level of aggressiveness as well aslong lasting effects on health and well-being [4]. Most research work related to vehicle drivers have been done predominantly in the context of drivers in the developed nations. Driving in a developing country is a highly different experience [5] and our goal is to formally study the driving experience from the perspective of drivers in the developing nations, starting with Dhaka.

Figure 1: Traffic in Dhaka (a) Severe Congestion [3] (b) Excavated Road [1].

We have studied the driving experiences using sensor based automated methods as well as qualitative methods that bring out the feelings related queries from drivers. Our discussions gave us a direction on the factors that affect the drivers the most. These measures could hep in formulating targeted interventions to enhance driving experience. To the best of our knowledge, our work is the first instrumented vehicle study in Bangladesh, and very likely, in South Asia.

2. SENSOR-BASED STUDY

Our sensor-based study involved most of our resources in terms of design, development, deployment and testing of sensor-enabled systems that may support a driver. *Sensing*

[1]Here 'driving experience' is not to be confused with the concept of *how long a driver has been driving* (measured by years or by mileage).

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Uneven Roads: The custom built sensors have been built using Arduino connected to a MPU-6050 Accelerometer to capture the motion in X, Y, Z direction as can be seen in Figure 2-(b). An illustration of various road trips is shown in Figure fig:hardbk-(a). It can be observed that the X and Y-axes data do not vary a lot through various road conditions while Z axis shows visible changes through bumpy roads. *Sensing Hard Brake:* The brake sensor is used with inexpensive and available ultrasonic sensors attached beneath the brake pedal; a hard brake is detected by the ratio of the distance from the pedal to the floor and the time length during which the pedal has been pressed, calibrated to provide readings in centimeters and time is recorded using Arduinoas seen in Figure 2- (b) and (c). *Measuring Experience through Facial Expressions:* We have used a video recorder program that is able to record the driver expressions as well as the surrounding road conditions using two cameras in an advanced mobile phone as can be seen in Figure 2-(d). This is an intrusive technique as the driver is aware of the sensing mechanism.

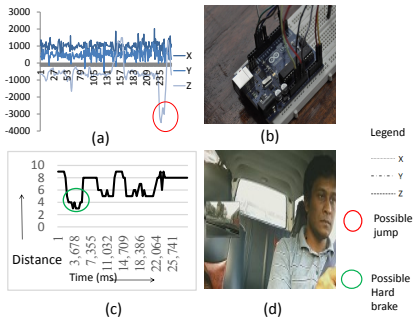

Figure 2: Sensors used in study (a) Road jumping mesurement (b)Hard BrakeSensor (c)Measuring hard brake (d) Video Sensing.

It is interesting to note that the sensors are able to reflect the information of the road conditions. However, the user experience varies a lot from person to person and requires some level of communication involving human interaction.

3. QUALITATIVE STUDY

Our qualitative study involved 28 drivers sharing their experiences in a semi-formal and informal setup. The informal setup was needed to talk to the rickshaw pullers who preferred liberty to speak in a free format and often changed topics at their own will . We offered a choice of TK 100 (less than 1 GBP) or phone credit of equivalent value to all our participants. We asked for car drivers using snowball sampling [2] and the study expanded by word of mouth for private car drivers. We approached rickshaw pullers and commercial drivers directly on roads and through known links. Our summary of study is presented in Table 1[2].

4. CONCLUSIONS

Driving experience plays a very important role on the traffic behavior and road safety. The experience can be crucial if the traffic situation itself is challenging. We have explored ways to find out about driver's experiences and identified factors that govern driving experience in an urban scenario with chaotic multimodal traffic in the context of Dhaka, Bangladesh. We have conducted instrumented vehicle study, unprecedented in the context of Bangladesh and supplemented it with qualitative studies. An extended study in this area can significantly improve the safety aspects and overall well-being of the drivers.

[2]The numbers in the right two columns of Table 1 will not add up to the total counts in the leftmost column as some drivers mentioned multiple factors

Table 1: Summary of Qualitative Study

	Action during Unexpected Events	What Irritates you
commercial drivers (total: 8)	• hard brake (7) • sometimes hard brakes do not help (1)	• bumpy roads (1) • traffic jam (1) • long driving hours (8) • hunger (1) • comments from backseat (8)
private drivers (total: 8)	• hard brake (5) • slowdown (2) • yell (1) • understand human behavior (1)	• traffic jam (1) • very tired (1) • full stomach (1) • behavior of bus drivers(3) • parents advising how to drive (1) • phone calls (1)
rickshaw pullers (total: 10)	• do not want to brake. Move to side instead (10)	• When braking is needed (all) • hunger (all) • long hours of duty (all)

5. REFERENCES

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