

# OVERVIEW ON PASSENGERS OVERLOAD CONTROL IN PUBLIC BUSES CASE STUDY: TANZANIA

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**Abstract:-** Passengers overload in public buses has been a problem in Tanzania. Despite some stationing police at different locations for manual check being in place, the overloading of passengers still persists. The current system doesn't work efficiently as the check is done at random, and it is difficult during the rainy seasons and at night and it is costly and needs labor power. The findings indicate that many deaths and injuries when accidents occur, they cause deaths and injuries mainly if there is passenger overloading or if the passengers are not wearing seat belts or both. Many people lose their lives and some are severely injured when accidents occur in these public buses. This paper checks an overview on the current system and proposes a new system which uses new technology for controlling passengers overload in public buses to overcome the challenges of the current system. The proposed system will help in controlling excessive passengers and hence reduce the number of deaths and severe injuries. It will also reduce the possibilities of bribe and reduce cost and labor power. Finally the standard and comfortable passenger system for public buses can then be attained.

**Keywords—**APC, SUMATRA, MAAP5, Safety, Overload

## INTRODUCTION

Carrying more passengers than capacity by bus has been a problem in Tanzania. Some other buses squeeze people in the spaces between the seats. Example a space of 4 passengers will accommodate 5 passengers. Why have passengers become agents and disciples of impunity in the bus industry? The worst part is that the money never reaches the owner it goes into the pockets of the drivers and the conductors. In the situation when someone complains or refuses to squeeze the conductor and some of the passengers will tell them to buy their own car. The importance of controlling overloading passengers cannot be ignored because it helps to reduce deaths and casualties as the findings show that excessive passengers is one of the major causes of many deaths and casualties when accidents occur. There should be a way of controlling that because passengers have to sit and wear seat belts for their safety[1]. It is clear that, at some point, we need to limit the number of extra passengers to be accommodated. Worldwide people invest in quality control programs in order to assess and improve the services provided to the passengers[2]. The risk of being killed in a traffic accident in Tanzania proportionate to the number of vehicles on the road is 20-30 times higher than in the USA and many countries in Western Europe. Despite these heavy losses, road safety measures in Tanzania are characterized by

procrastination and short lived symbolic crackdown on vehicles following a tragic road traffic accident[3].

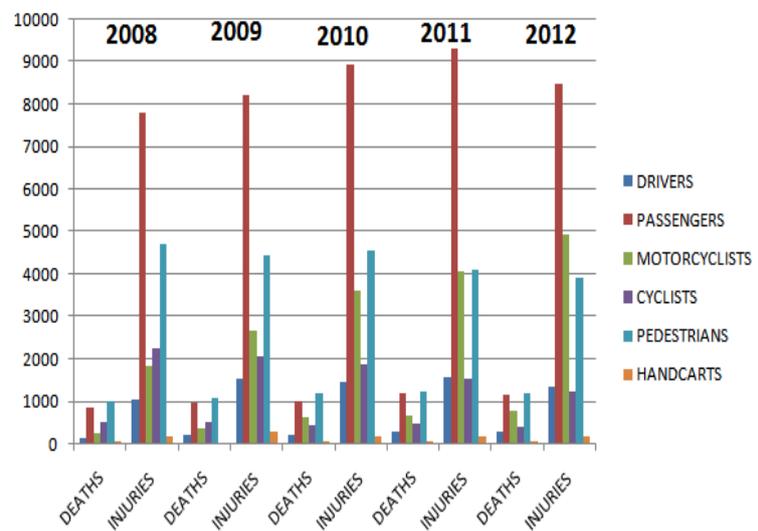


Figure1: Trend for accidents in Tanzania

The figure above depicts a trend which shows a significant progressive increase in the number of deaths and casualties in five years. As mentioned above some of the casualties sustain irreversible physical injuries and end up with permanent disabilities. The extra passengers who will definitely not have seat belts on are more likely to sustain injuries or even deaths.

Since the insurance policy does not cover the extra passengers, these will suffer a further greater damage health wise and also economically. Based on the statistics, approximately 27,000 civilians are killed in car accidents in some developing countries each year[4].

## **CURRENT SYSTEM**

The current system for controlling overloading of passengers in public buses in Tanzania is manual checks. Manual check is done by stationing police officer at different locations. The manual check can be demanding at times like at night or during poor weather. It increases the possibility of bribe as the bus attendant can bribe the traffic police. It is not accurate, as it done at randomly hence they cannot check all the buses. It is also costs and requires vast manpower. Traffic stops are inherently dangerous for police officers, many of whom patrol and conduct stops solo. Officers typically take steps to protect themselves from passing traffic such as using their own car as a shield and/or approaching the suspect vehicle on the passenger side. Traffic police stop a vehicle on which they have strong reasons to believe contains a driver or passenger suspected of having committed a serious crime, especially of a nature that would lead the police to believe the suspect may be armed (such as excessive passengers, reckless driving, checking the car registration, insurance etc). People who use public buses risk their lives every day on the road. If passengers feel unsafe on public transport, they will try to use their own vehicles but there are very few people who can manage to own vehicles, most of the people in developing countries depend on public buses. In fact, the use of public transport should be promoted because it would help save energy. In addition, the promotion of public transport will help to reduce pollution. If people turn to public buses, they would reduce the number of vehicles and the amount of emissions. Unfortunately, public buses do not always provide a safe means for people to move from one place to another. Most of people killed in traffic crashes are passengers. It is mandatory for drivers and passengers to wear seat belts.[1]. If there are excessive passengers then it is impossible for them to wear seat belts. A computerized accident recording and analysis programme known as MAAP5 has been in use in Tanzania since 1995. The program is now in use in 8 out of 20 regions in the country and plans are to introduce it to the remaining 12 regions. Data is collected from the upcountry regions to a central database at the Traffic Police headquarters and is then used by different stakeholders. However there are mistakes that are made by the staff that enter data into the computer. These are corrected and short courses are held from time to time to make the staff more competent. The Ministry of Works has started using data from Dar es Salaam region to propose countermeasures to accident black spots identified by MAAP5[3].

Currently there are many technologies introduced for counting passengers but they are doing so for other purposes not to control the overload. I can point out some studies done in other parts of the world that count passengers and use different technology for counting passengers. The purposes for these other studies however vary enormously from controlling overloading of passengers in public buses. Some studies for example demonstrate the use of GSM and GPS technology to track cars[5, 6], in anti theft system and some used this

technology in accident alert and locator[7], and other to see that buses travel in the assigned routes[8].

Other studies report on the use of APC data to develop a model to predict bus arrival times[9, 10] and other researchers have used APC data to calibrate or validate travel models[9, 11].

## **DIFFERENT TECHNIC FOR COUNTING PASSENGERS**

### **VIDEO PROCESSING**

This is one of the types of passengers counting system which is counts passengers who are get in/out of a bus based on video processing. The basic scheme is to set a zenithal camera in the bus for capturing the passenger flow bi-directionally. The captured frame is firstly divided into many blocks and each block will be classified according to its motion vector. If the block quantity of similar motion vectors is more than a threshold, those blocks are regarded as belonging to the same moving object. As a result, the number of such moving objects is counted to be the passenger number of getting in or out of a bus, can be segmented for counting. Experimental results show that the proposed bus-passenger counting algorithm can provide a high count accuracy of 92% on average[12].

We present a single-camera-based vision system that is able to count passengers in a highly crowded situation at the entrance of a traffic bus. The unique characteristics of the proposed system include, first, a novel feature-point-tracking- and online clustering-based passenger counting framework, which performs much better than those of background-modeling-and foreground-blob tracking-based methods. Second, a simple and highly accurate clustering algorithm is developed that projects the high-dimensional feature point trajectories into a 2-D feature space by their appearance and disappearance times and counts the number of people through online clustering. Finally, all test video sequences in the experiment are captured from a real traffic bus. The results show that the system can process two 320\_240 video sequences at a frame rate of 25 fps simultaneously, and can count passengers reliably in various difficult scenarios with complex interaction and occlusion among people. The method achieves high accuracy rates up to 96.5%[13].

### **IFRA-RED MOTION ANALYZER**

This are another types of passengers counting system which is counts passengers who are get in/out of a bus based on the "Infra-Red Motion Analyzer (IRMA)". It is based on passive, non-radiating infra-red technology to detect and count people moving through a door or gate. The system utilizes specifically developed high-quality sensors with integrated optic elements which allow for both accurate passenger counts and discrimination between boardings and deboardings through one single sensor. The standard equipment consists of one infra-red sensor, mounted in the door frame, and an analyzer unit to

transform the sensor information into counts and transmit the data to the onboard data collector. The system can be provided as a “stand-alone” solution or as an integrated component of “Intelligent Transportation Systems”. Integration into third party on-board equipment can be performed via the on-board communication network and standard communication protocols. Due to the small dimensions, the equipment is flexibly adjustable to various types of vehicles and easily mountable. IRMA is successfully operating in stations, rail cars, light rail vehicles, trolleys, regular buses, low-floor buses, and also in applications beyond transit such as airports, hospitals, and banks. Since IRMA has the reputation of providing accurate counts, the system has successfully been delivered to and integrated by various suppliers of “Intelligent Transportation System (ITS)” and is used in more than fifty (50) applications throughout Europe. The “Infra-Red Motion Analyzer (IRMA)” system utilizes passive infrared sensors to detect and register the thermal image of persons moving through a door or gate. The functioning is based on the fact each individual person emits thermal long-wave infrared radiation which creates a temperature contrast to the person’s environment. This radiation can be measured by special pyro-electric detectors which are exclusively used in the IRMA system. The most significant feature of the detectors is that they only perceive temperature radiation when changes occur[10].

## STEREOVISION

Stereovision is another system for passengers counting in buses. The processing chain corresponding to this counting system involves several blocks dedicated to the detection, segmentation, tracking and counting. With this technique, the objective is to determine the information distance from the sensor to each point of the scene. This distance is inversely proportional to the disparity. It can be dense stereovision or sparse stereovision. The basic idea of our proposed system is, from disparity maps calculated with a specific stereo matching, to isolate and separate the passengers’ heads in order to count them. To achieve that, the sensor is fixed vertically above the door of the bus. With this configuration, we lower the occlusions problems and whatever the crowd configuration, we suppose that the passengers’ heads will rarely touch each other. The processing chain comprises four blocks: detection with stereo matching, segmentation, tracking and counting. The detection block calculates, for each pair of stereoscopic images, a dense disparity map which is converted into height map. On each map, are represented distances from the ground of each point of the scene. The height maps are segmented in order to highlight the passengers’ heads at different levels (adults, teenagers, and children). The result of this step is binary images containing information related to the heads; we call them “kernels”. The extraction block attributes a number of parameters to the kernel: size of the kernel, shape, average grey level, and average height level. Then, with the previous information on the kernels, a tracking procedure is applied to

analyze the trajectories of the kernels. In this system we can obtain counting accuracy up to 99%.

## PROPOSED SYSTEM

The nation's growth and the need to meet mobility, environmental, and energy objectives place demands on public transit systems. Current systems, which are old and in need of upgrading, must expand service area, increase service frequency, and improve efficiency to serve these demands. Research is necessary to solve operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the transit industry[14]. In the past, passenger count was mostly tiring and was both labor and cost intensive. So, it is important to develop an automatic method for counting passengers[15]. Many experts are currently working on different projects to increase the safety of automobiles and decrease the number of accidents on the roads. Currently in Tanzania the technology keeps growing each day. There is a need to change from manual control to automatic control of excessive passengers. We have some good coverage for mobile network along the major roads. We have fiber optic in most parts of the Country Region. There is growth of ICT Industry in Tanzania; hence the introduction of new technology can be a great start in the transport area. The new systems will automatically control the excessive passengers in public transport and enforce safety of the passengers. Worldwide people invest in quality control programs in order to assess and improve the services provided to the passengers. The table below shows the number of public service vehicles that are being registered each year. There has been a steady increase in the number of registered vehicles. This justifies that if the system for controlling excessive passengers is to be implemented, it can be put into effect in each public vehicle that is being registered.

Table 1: Registered public car in different region in Tanzania.

		2006	2007	2008	2009	2010	2011
SN	REGION	PSV	PSV	PSV	PSV	PSV	PSV
1	Dar es salaam	9016	8259	8973	10014	11657	11425
2	Morogoro	260	315	124	611	949	1288
3	Mtwara	144	257	308	294	230	323
4	Lindi	80	95	176	141	142	152
5	Pwani	1	36	1880	434	987	44
6	Mwanza	1039	1189		2082	2380	2491
7	Kagera	127	300	285	402	519	787
8	Mara	172	157	101	262	378	552
9	Shinyanga	166	149	141	272	253	336
10	Mbeya	738	1088	1151	1115	1433	1303
11	Iringa	406	511	485	507	626	803
12	Rukwa	39	49	54	67	78	164
13	Ruvuma	259	299	232	259	338	417
14	Kilimanjaro	3071	3717	4271	2779	2707	3160
15	Arusha	778	785	1355	2989	4672	4878
16	Tanga	637	517	612	1077	1170	1154
17	Manyara	35	88	63	78	181	263
18	Dodoma	704	740	708	977	1430	1582
19	Singida	87	168	291	289	583	786
20	Tabora	94	134	114	64	252	342
21	Kigoma	503	330	383	401	641	770
	<b>Total</b>	<b>18356</b>	<b>19183</b>	<b>21707</b>	<b>25114</b>	<b>31606</b>	<b>33020</b>

In this way we can be sure that in a year a min of eighteen thousand and maximum of thirty thousand public vehicles will be equipped with this system for controlling passengers overload and we can also be sure of cutting down the risk of deaths and disabilities occurring to excessive passengers during accidents. We can opt one of the technique described above to implement the system for controlling passengers overload in public buses. We should consider the technique that is affordable in our developing country like Tanzania. As the bus owner could easily be able to adopt and use them without complaining about the cost for using the system.

## CONCLUSION

The current situation for controlling overloading passenger in public buses needs to be improved. As the manual check is difficult during the bad weather such as rain, difficult at night, can increase the possibilities of bribe its costs to operate and it need immense labor power. Apart from that it is not accurate as the checks are done at random not all the buses are checked. There is a need to device a new system which can overcome all these difficulties. As the technology is growing we need to utilize it for the development of our country. If we opt for the new system we will benefit from the following.

- Solve the Problems of dealing with excessive passengers in public buses.
- It will reduce cost and labor power.
- It will improve the current system by getting rid of manual check which sometimes fails due to poor weather such as rain, difficult to do manual check at night, it's not accurate because check is done at random, it doesn't check all the buses.
- It will reduce the possibility of bribe as through manual check the bus owner can bribe the traffic police officer.
- It will reduce deaths and severe injuries in accidents involving buses with excessive passengers.

## RECOMMENDATIONS

This study was conducted to overview the safety of passengers in public buses in Tanzania specifically on controlling overloading of passengers. During conduction of this study we observed that we need to adopt the new system for controlling passenger overload. It is quite challenging to completely guarantee passenger safety in public buses. There are many other factors apart from overloading of passengers which directly or indirectly interplay to lead to deaths and injuries during accidents. Controlling excessive passengers in public buses however entails to solve part of the problem. It will cut down the number of passengers who would be severely injured or even die during accidents in public buses with excessive

passengers. There is a need to find solution on the other issues regarding passengers safety not only passengers overload. Network coverage is limited in some of Major roads hence there is an inevitable need to strengthen network coverage along the major roads for new system to be put into appropriate use. Failure to wear seat belts has been proven to be one of the reasons for many deaths and injuries during accidents, not only in public buses but also in private vehicles. There should be a way to develop a mechanism which will ensure that all passengers in public buses wear seat belts. The public transport organizations and operators need to take major initiatives towards developing a modern transportation system which passengers can find attractive and safe. There is a need to establish an effective communication channel between all parties involved in the transportation system and better understand the needs and priorities of the passengers. A passenger satisfaction survey is also important in order to identify their priorities. Their expectations and satisfaction regarding transportation services is also crucial. This may include safety and comfort during the journey, safety at the stop points and terminals, buses travel and stop in the assigned routes and terminals.

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