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Design of Proprietary Protocol in Wireless Communication Network Foe Bus Bunching Avoidance System

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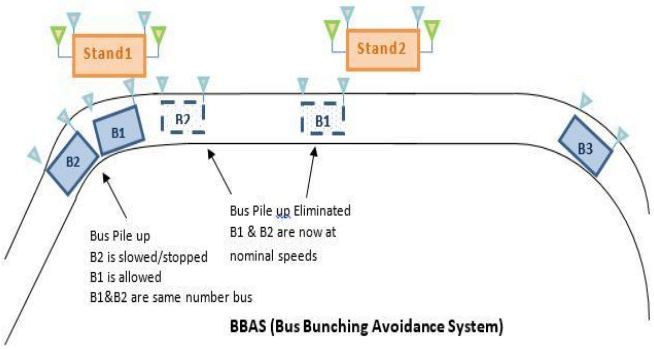
Abstract: The primary challenge for an urban bus system is to maintain constant headways between bus systems. In this work, we study a problem which has been bothering both passengers and operators in the public transportation system known as the bus bunching problem. It typically means 2 or more buses of same service route getting too close together so that they "bunch each other". It is undesired because it usually increases the waiting time of passengers before and after the arrival of the bunched buses. We analyse the cause of the bus bunching problem, and propose a new solution by designing proprietary packet protocols for wireless communication between buses and bus stands.

1. Introduction

Intelligent public transportation system (IPTS) is the new trend which is been emerging at various cities. The main aim of this system is to improve efficiency and quality of the system so that more people will be attracted to public transport. These Intelligent systems provide bus arrival times to users. In some systems, it also monitors all the buses of all the routes and changes the number of bus on routes automatically as per requirement, ticketing systems are also electronic which saves time and hassles.

IPTS is the future and with time, new features and options are added into the system with the help of wireless communications. Many innovators have added various features to improve transport ranging from route optimization to GIS based enhancements. Our project is also one of that, we intend to implement a feature to avoid the bus pile up or bus bunching at single places or at bus stands with the design of proprietary network protocol and system.



2. Methodology:

Bus bunching avoidance system is basically a wireless communication project with multiple wireless nodes. In this project we design a wireless network consisting of 3 types of nodes i.e., bus node, stand node, depot node.

We also have to design protocol which suits our project. Hence we develop a packet protocol system. We are also designing a wireless network using RF modules. Our scope is limited to design a wireless network using 2.4GHz CC2500 based transceiver module and suitable protocol packet.

3. Block Diagrams:

In the bus module, represented by Fig.1, we develop I2C driver for EEPROM and RTC interfacing on bus so that the bus is capable of storing all events for data analysis and driver complaints.

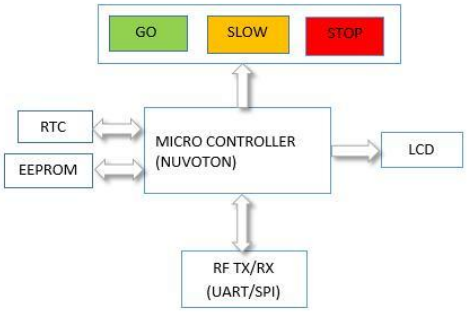


Fig.1 System of a bus

In stand part, represented by Fig.2, we develop bus bunching avoidance system using queuing algorithm. We make bus arrival-departure queue and when a bus arrives we find bus bunching situation and instruct the driver by giving appropriate commands.

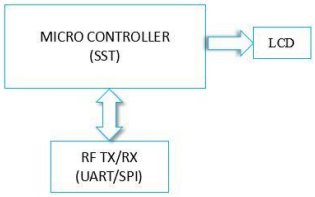


Fig.2 System of a stand

In depot, represented by Fig.3, we just do communication and packet formatting i.e., conversion of packets into human readable form and transmitting to PC. At PC any terminal program can be used to display this data but actually it has to be displayed and stored in some oracle or SQL database for data analysis.

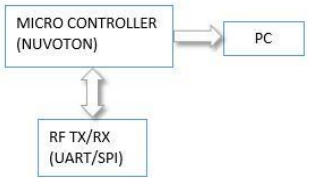


Fig.3 System of a depot

We only instruct the driver using audio visual indicators. We are not interacting with bus engine or directly monitoring the bus speed. We time stamp the events in EEPROM. The next stand decides whether the driver has followed the instructions of previous stand and gives suitable warnings. These warnings are also stored in EEPROM and at the depot complete log is downloaded. If the driver has multiple warnings, then suitable actions must be taken against the driver.

4. Results:

4.1 Flow of Communication:

These images show the flow of packets (mode of communication) between the bus and the bus stand.

Fig.1 Fig.2

Fig.3

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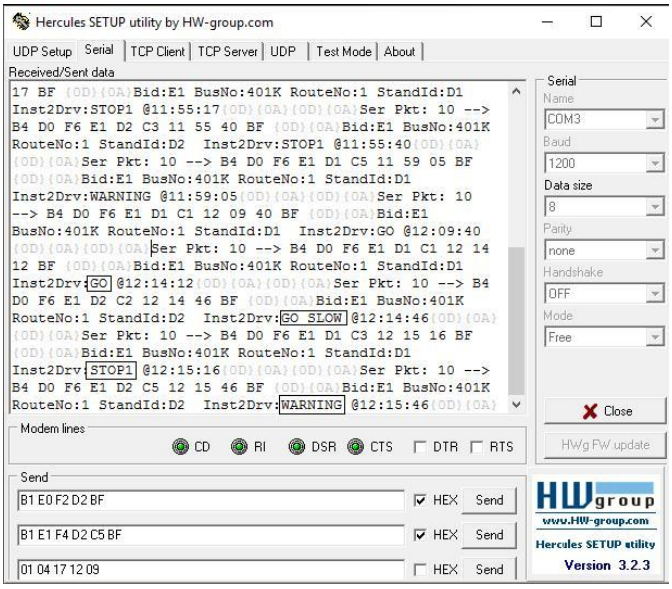

5. Conclusion:

In our project, we have successfully implemented dynamic queuing algorithm and wireless network to avoid bus bunching and demonstrate with the help of hardware design by us.

5.1 Advantages:

- Bus pile ups will be avoided and hence, commuters will reap the benefits in terms of better transport services and less waiting periods.
- System is easy to implement and understand. Running cost is low.
- Commuters will prefer public transport.
- Low consumption of fuels.
- The public transport system can be made more organized.

5.2 Limitations:

- Initial setup cost is high.
- Theft of electronics system from buses and bus stops.

5.3 Future Scope:

5.4 Our project can further be advanced by displaying the bus arrival time on the bus station to keep the passengers informed about the next upcoming buses.

5.5 We can make use of sensors in the system because theft of electronic gadgets is more in some places of the city.

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