

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/323027620>

Smart Bus: An Automated Passenger Counting System

Conference Paper · January 2018

CITATIONS

2

READS

5,934

4 authors, including:



Jafrul Islam Sojol

North South University

4 PUBLICATIONS 2 CITATIONS

[SEE PROFILE](#)



Nayma Ferdous

North South University

1 PUBLICATION 2 CITATIONS

[SEE PROFILE](#)



Tamanna Motahar

University of Utah

23 PUBLICATIONS 15 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Exploring Challenges and Solution Approaches Regarding Wellbeing of Female Rohingya Community in Bangladesh [View project](#)



Rickshaw Buddy [View project](#)

Smart Bus: An Automated Passenger Counting System

¹Jafrul Islam Sojol, ²Nayma Ferdous Piya, ³Shalim Sadman, ^{4*}Tamanna Motahar

¹²³⁴Department of Electrical and Computer Engineering, North South University
Dhaka, Bangladesh.

Email: {jafrul.sojol,ferdous.piya, shalim.sadman, *tamanna.motahar}@northsouth.edu

Abstract

Smart Bus: An Automated Passenger Counting System is a hardware and mobile-based application system. This research involved the design and implementation of automated passenger counting which provides a solution to remove syndicate and corruption in the transportation sector. It counts how many passengers are sitting on the seat and shows on the display screen in real time monitor and the authority can see the total number of passengers. No paper receipt is needed to ride on the bus. It enables transport authority to obtain accurate bus fare from bus drivers and helpers remotely instead manually counting where corruption happens. This system is made with Arduino Uno, Bluetooth HC-05 module, pressure pad, potentiometer, data collection software module (Arduino IDE, Bluetooth terminal HC-05). The proposed passenger counting system would be beneficial for both bus owners and government (BRTC- The Bangladesh Road Transport Corporation). As a working prototype, this system has been detecting 3 seats with an accuracy rate of 90%.

Keyword: Smart bus; Automated Passenger Counting in Bus; Pressure Pad; Digital Display Screen; Bluetooth HC-05.

1. Introduction

Bangladesh is ranked 4th in the world's most populated country. According to the population survey of 2014, the Great Dhaka city has the population of approximate 1.7 crore people [1]. Moving around inside the most densely populated city like Dhaka, turned out to be a headache for every general people. Due to the high travel fare in Taxi cabs, CNG and UBER, most of the people cannot afford them. So, they choose local bus services as their preferable transport because it is the cheapest and efficient way to travel but they had to face another problem which is corruption. This is a prime reason behind an unorganized transportation system. The drivers and the helpers don't care about their customer's comfort. They take passengers as much as they can and they give less amount of money to their authority. But it is possible to overcome this problem through an automated transport system. Our automated bus service will work like a virtual helper for the bus authority.

2. Concept Review

2.1 Proposed System

In our proposed android system, any passengers who will board, it will be shown in the display monitor installed in front of the bus. No manual counting would be needed. If there is no passenger on seat, it will show a blank seat. But when a passenger will be seated on the bus, it will show occupied on the display screen. Display will change the color for each seat occupied. The display database updates in every 30 sec. There will be some checkers for every stoppage. When the bus reaches any stoppage, checker will enter into the bus. He will access into the display database by giving his login credentials and send the updated data to server. So that, from every starting point to destination, the actual number of passengers will be automatic counted and it will reduce the window of corruption.

2.2 System Design

In this system, it has a pressure pad beneath every seat and the pressure pad acts like an open circuit connected to Arduino microcontroller and variable resistors. When passengers are sitting on the seat, pressure pad becomes closed circuit and passes the voltage into the circuit. The voltage goes to Arduino IDE and the Arduino converts the voltage into a digital signal like 0, 1. It means when a passenger is sitting on the seat, it passes the value as 1. Also, when there is no passenger, it passes the value as 0.

2.3 Work Flow process

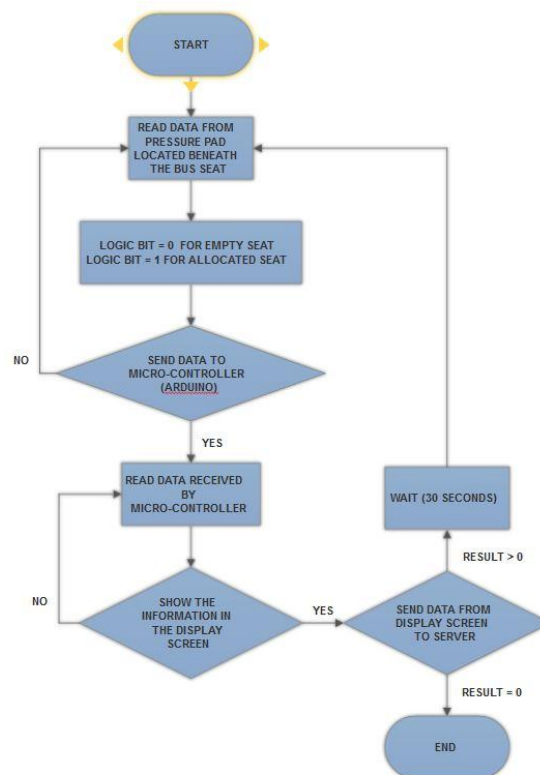


Figure 1: Flowchart of the Proposed System

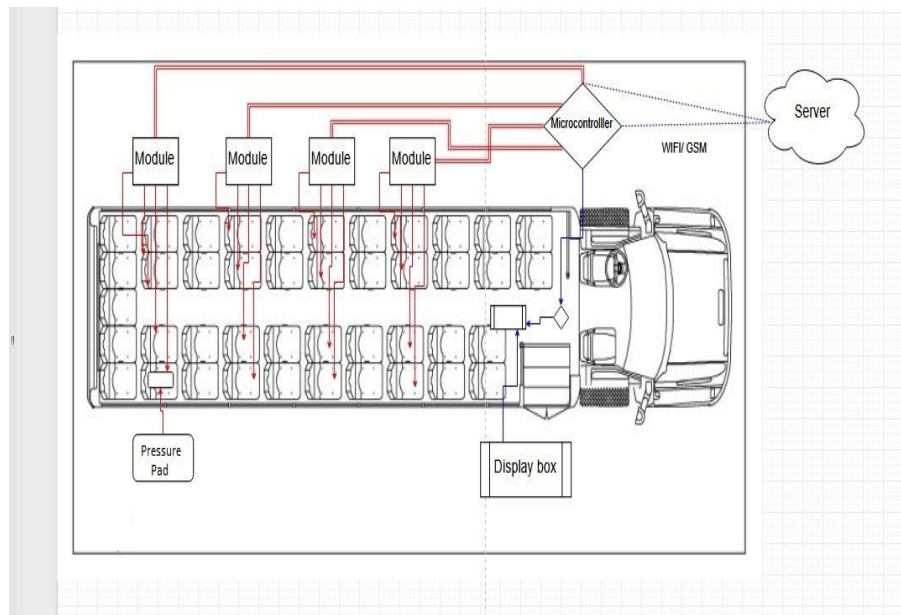


Figure 2: Proposed System Architecture

2.4 Operating Environment

List of Hardwires

1. Arduino Uno (microcontroller)
2. Bluetooth HC-05
3. Potentiometer
4. Pressure pad
5. Touch screen display/ Tablet

List of Software and Programming Language

1. Java
2. XML
3. MySQL
4. PHP
5. Python
6. Android Studio
7. Arduino IDE
8. HC-05 Bluetooth Terminal

2.5 Circuit description

Phrase 1: Making Pressure Pad

We made a pressure pad which will work as a pressure sensor for our project. Pressure sensor does its job as a pressure-sensitive component which measures the pressure of an object and converts the experiment value into an electrical signal output. We made the pad by placing aluminum paper and foam sandwiched between two cardboards. The foam will work as an inductor between cardboards. With the help of two wires, pad directly connected to the Arduino. As shown in the figure3, when we give a pressure on the pad, it activates and gives an analog signal.

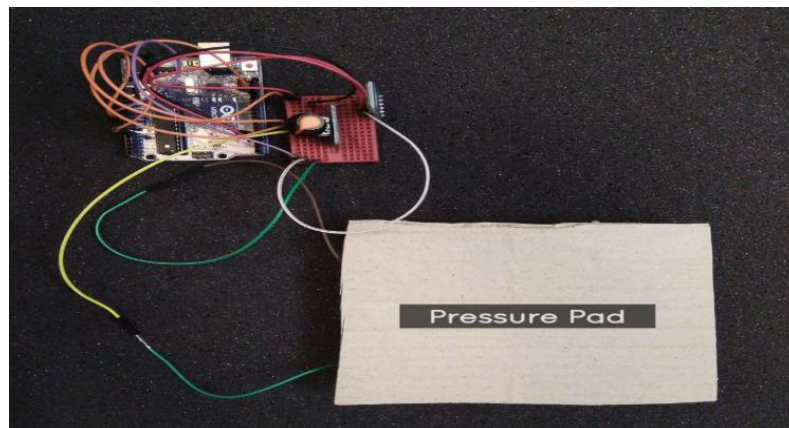


Figure 3: Pressure Pad Connected With Arduino

Phrase 2: Using Arduino Uno

Pressure pad is connected to Arduino through a bread board. In the Arduino board, we connected one terminal of the pressure pad to the 5V DC supply and the other across the VCC terminal of the potentiometer. Later, we connected the GND to the Arduino board and the signal to the analog AO port. This would give an analog voltage signal when a pressure was applied to transmit the signal using a module. We converted the analog signal to digital signal (1 and 0) using Arduino IDE.

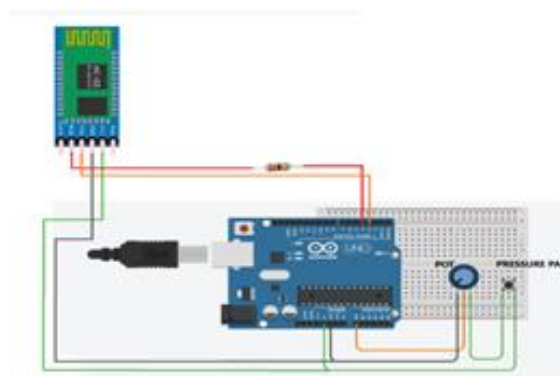


Figure 4: Block Circuit Diagram of the Proposed System

Phrase 3: Process Operating Bluetooth Terminal HC-05

We have used HC-05 Bluetooth module to transmit the signal because it is the most economical and easiest way to go wireless and also designed for transparent wireless serial connection setup. For conduction we get 1 and for open we get 0(zero). We connected the VCC and GND to the Arduino board and the TXD to port 3 of PWM region and the RXD through a resistor to the PWM of the port 4. As shown in figure 8, Bluetooth detected the value as on/off which represents whether there is any passenger in a seat or not.

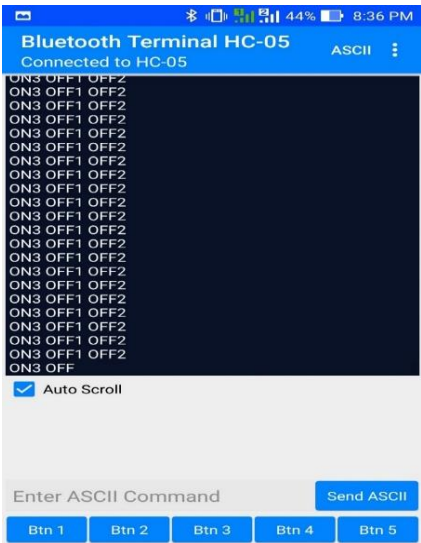


Figure 5: Receiving output from Bluetooth Terminal HC-05

2.6 Application Description

The display was designed for android mobile platform. We added different features like seat icon, checker id, password and complain box. After entering the bus, checker gives his login credentials and send updated info to authority server. In the complaint box, the passenger can complain about the driver, or service to the authority.

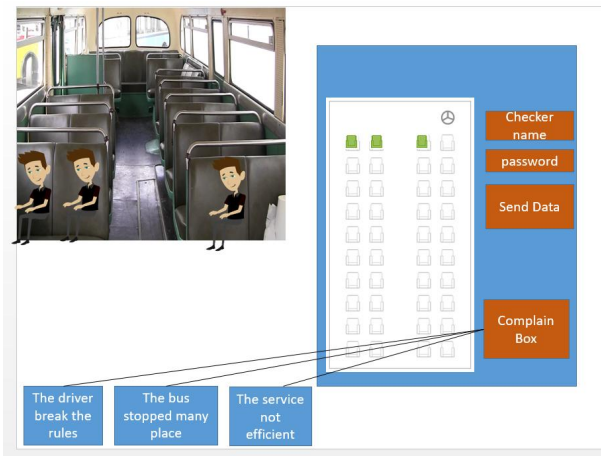


Figure 6:Proposed System API

3. Result and Discussion

We have done testing for three consecutive seats to compare the results. In this stage, we checked several functionalities. 1st of all, we checked the pressure pad whether it is working properly to pass the value or not. After that, we checked display screen. When we created pressure for a seat, display became RED color which means that particular seat is occupied. Later, we checked if the data is going to server accurately or not. The result comes in affirmative. Then the data goes to the server and authority can monitor the whole system.

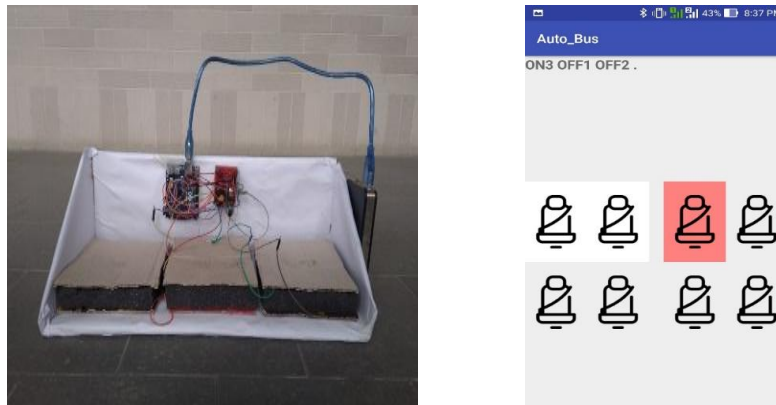


Figure 7: (a) Proposed hardware implementation, (b) Output in the display screen

We also examined the bus seats to figure out if our system can detect the seats and verify total amount of weight it required to send data. In the table 1, it is shown the different weights on the single seat that we have tested and the observed results if any signal was coming out or not. We came out with these readings.

TEST NUMBER	WEIGHT (KG)	RESPONSE	METER READING	SEATING PATTERN
1.	0	0	Not seated	-----
2.	2	0	Not seated	-----
3.	4	0	Not seated	Unknown
4.	8	0	Not seated	Unknown
5.	12	0	Not seated	Unknown
6.	16	0	Not seated	Unknown
7.	18	0	Not seated	Unknown
8.	20	1	Seated	Normal
9.	30	1	Seated	Normal
10.	44	1	Seated	Normal
11.	57	1	Seated	Normal
12.	61	1	Seated	Normal
13.	75	1	Seated	Normal
14.	89	1	Seated	Normal

Table 1: Different weights on the seat

Here we tested for empty seat first and there was no signal (0 in the output). 0 means not seated. After that, we put different weights but under 20KG there was no response. When we put 20KG on the seat, result was 1 which means seat occupied. So the pressure pad is able to detect a weight of 20KG or above. We put highest 89KG weight and we could put more weight on the seat.

4. Conclusion:

In this paper, we have presented an automated system for passenger counting in sitting service bus. The proposed project provides efficient and innovative way to give complete access, flexibility and satisfaction to the authority. It will work like a virtual helper. Corruption problem cannot be erased in one day but it can be cured if we stand against the matter. Our system can be a milestone to reduce the corruption in public transport system in Dhaka.

References

Website Article

- [1] Rising population big concern for Dhaka. (2014, July 13). Retrieved from <http://www.thedailystar.net/rising-population-big-concern-for-dhaka-33081/>
- [2] Hossain, M. (2016, November 28). Nightmare of the public buses. Retrieved from <https://www.thefinancialexpress.com.bd/print/nightmare-of-the-public-buses/>

Journal

- [3] Choudhary, M., 2013. An Automated Transport Management System. IOSR Journal of Computer Engineering (IOSR-JCE), 11(3), pp.17-21.
- [4] Wang, W., et al. 2011. Bus Passenger Origin-Destination Estimation and Related Analyses Using Automated Data Collection Systems. Journal of Public Transportation, 14 (4), pp.131-150.
- [5] Chandrakumar, K., Kowsalya, C., 2017. Theft Identification and Automated Passenger Count Management System Using Internet of Things. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE), 6(9), DOI:10.15662/IJAREEIE.2017.0609016.
- [6] Chandurkar, S., Mugade, S., Sinha, S., Misal, M., Borekar, P., 2013. Implementation of Real Time Bus Monitoring and Passenger Information System. International Journal of Scientific and Research Publications, 3(5).
- [7] Menon, A., Sinha, R., Ediga, D., Iyer, S., 2013. Implementation of Internet of Things in Bus Transport System of Singapore. Asian Journal of Engineering Research, 1(4), pp. 08-17.
- [8] Rahman, S., Nahrin, K., 2012. Bus Services in Dhaka City-Users Experiences and Opinions. Bangladesh Institute of Planners, vol.5, pp.00-00.

Conference

- [9] Bernini, N., Bombini, L., Buzzoni, M., Cerri, P., Grisleri, P., 2014, September. An embedded system for counting passengers in public transportation vehicles. In 10th International Conference on Mechatronic and Embedded Systems and Applications (MESA), 2014. IEEE.
- [10] Gaurav, K., Agrawal, S., Reddy, K., 2004, December. Towards an It-based Bus Information System to Improve Bus Occupancy in Hyderabad. In 7th International Conference on Information Technology, CIT 2004, Hyderabad, India. Pp.396-405.
- [11] Jau-Woei Perng., Wang, T-Y., Hsu, Y-W., Wu, B-F., 2016. The design and implementation of a vision-based people counting system in buses. In System Science and Engineering (ICSSE).

[12] Chen, C.-H., et al., 2008. People counting system for getting in/out of a bus based on video processing. In Intelligent Systems Design and Applications, 2008. ISDA'08. Eighth International Conference on IEEE.

Authors Biography



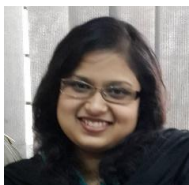
Jafrul Islam Sojol is an undergraduate student of Bachelor of Science in Computer Science and engineering from the department of electrical and computer engineering at North South University. His area of interest include Artificial Intelligence and Image Processing.



Nayma Ferdous Piya is an undergraduate student of Bachelor of Science in Computer Science and Engineering from the department of electrical and computer engineering at North South University. Her research interest include embedded system, internet of things (IoT), VLSI technologies and computer architecture.



Shalim Sadman is an undergraduate student Bachelor of Science in Computer Science and engineering from the department of electrical and computer engineering at North South University. His area of interest include Computer Network Architects, VLSI Technologies and Computer Architecture.



Tamanna Motahar is a lecturer in Electrical and Computer Engineering department at North South University, Dhaka, Bangladesh. She earned her M.Eng. Degree at University of Alberta, USA. She specializes in computational electromagnetics, Human Computer Interaction and computer simulation.

