Project Proposal for Internet of Things Lab 2015

NIT Trichy

Smart Public Bus System

Domain: Automotive

Team:

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Abstract:

The proposed project is about making a smart Public Bus Transport System. It is a step to make the bus timings less erratic. The passenger waiting at the bus stop will get to know the arrival timings of the bus they are expecting. In a system which involves more than a million passengers using the public transport system on a daily basis, it will lead to a tremendous increase in reliability, efficiency and time savings from the passengers side.

The system makes use of wireless transmission using Arduino to indicate to the passenger waiting at a bus stop about the position of the bus through a display fixed at the stop. In big cities like Chennai, consisting of a large fleet of buses this system can prove economical and effective.

Introduction:

In the proposed prototype of the system, we use two arduino uno boards, and a 433 Mhz radio transmitter/reciever pair. Each bus route is assigned with a unique 10-bit code. The transmitter with an arduino board is attached to every bus.

A display meter consisting of the reciever, another arduino board, GSM module and some LEDs are fixed at every bus stop. The device lists the bus numbers followed by three leds to show position of bus and a fourth multicoloured LED to indicate the crowd level in the bus.

Market Analysis:

For our case study we shall consider the Metropolitan Transport Coorporation(MTC) bus service in Chennai. The MTC of Chennai consists of a fleet of about 3637 buses of various categories like ordinary, deluxe, superdeluxe, AC etc.

Compared to any other mode of transport, the public bus system is the cheapest and is the best option for office goers. Hence it manages a staggering 5.1 million users daily. But the energy and time lost in waiting for the buses seem to outweigh these benefits.

	2013
Depots	25
Fleet	3,637
Route	771
Employees	23,519
Passenger/day	4.967 million
Occupancy ratio	75.83%
Revenue/day	₹28,356,000

The biggest problem with the system as with any other public transport system is the erratic bus timings. This problem coupled with traffic jams in the peak hours makes life miserable for the daily commuters and office goers.

The situation reaches a peak during the night times, sundays

and state holidays when the drivers on their discretion cancel the last few buses of the day. The unwary passengers wait for upto an hour in anticipation of the buses.

Even the buses which arrive on time tend to be jam packed making it impossible for ladies and elderly people to board.

This system indicates to the passenger waiting in the bus stop about the position of the bus and how crowded it is. Based on these two factors passengers waiting in the stops can easily take a decision whether to wait for the bus or not. Some people who prefer share autos to crowded buses can also quickly opt for the former. This saves the peoples time during the office hours and the late hours.

Presently proposed solutions:

In 2010, a system was proposed to track the locations of the buses using GPS attached to the buses. Supposedly some 600 buses plying along 7 different routes were attached with the GPS system and tested for the effectiveness. But the system has not yet come into action. The problem with this system is that it is not accessible to everyone since it would require smart phones. Moreover data charges may apply for using real time tracking and maps.

Later in 2014, an app was designed which enabled the users to know the position and the crowd level of the buses. But this system is based on 'crowd sourcing technology' due to which it relies heavily on constant updates by the users about the position of the bus and hence did not catch up with the people.

Ease of adoption:

The proposed idea does not require any kind of large scale infrastructure to be implemented. The majority of the task lies only in mounting the readymade modules on the buses and the display meters in the bus stops.

The proposed idea may take considerable time to be implemented since it requires all the bus stops in a given route to be covered. Also not all the bus stops have proper shelters. Some are unofficial but yet popular bus stops. Hence the display meters need to be placed safely away from rain and direct sunlight. Also they need to be fixed sturdily to prevent being stolen.

The display meters need power to function. Since most of the bus stops have power connections for lighting, this shouldnt be a problem. In case there isnt one in place, to reduce the cost, we can integrate it with Lighted Display Ads.

Approximate Cost for large scale implementation:

Assume we plan to implement this on around 2000 buses in Chennai. Let us consider these buses ply along 600 different routes.

Now we have find out the number of bus stops. Now since many bus routes overlap, many of the bus stops will be covered by multiple buses. So for simplicity sake we shall take number of bus stops per route to be 10.

Bus modules: 2000 x (550 + 50) = 12 lakhs

Display Meters: 600 x 10 x (550 + 50 + 1000) = 48 lakhs

Infrastructure: 5 crore

Push button system: 5 lakhs

Total: 5.6 cr (approx)

Now considering that the MTC gets a revenue of about 28 lakhs a day, this amount can be easily recovered in due course of time owing to the increased number of passengers.

Project Description:

Each bus route is identified by a **10-bit unique identity number**. So a total of 1024 different bus routes can be covered by this method. Of course there is no limitation on the number of the buses, since the code can be extended to any any number of bits.

The **transmitter** is designed to continuously transmit the identity code every 30secs. The transmitter also transmits along with the identity code a two bit information on the crowd of the bus. So a total of 12 bits a continously transmitted. As the bus stops at the bus stop, the transmitted information is recieved by the devices at the bus stop.

The bus stop is fixed with a device which consists of the **reciever** that recognises the transmitted bus number and conveys an information to the devices down the route that the particular bus is on the way and its crowd level is so and so. This can be accomplished using a **GSM module**. The GSM module communicates this information to the next 6 Bus stops.

The **3 LEDs** would tell how many stops away the bus is(for each different bus number that cateres the bus stop). If all three glow, then 5-6 stops away. If two of them glow, then 3-4 bus stops away. And if one glows, 2 or less bus stops away.

4 mini push button switches are used to detect the passengers getting into or out of the bus. Two mini push button switches can be placed on two successive steps of both the doors. The output of the push button switch can be normally pulled up. When someone steps on them they are pulled to ground. The order in which they are triggered determines whether a person is getting into or out. This information goes to the microcontroller which keeps track of the count.

Note that the counting system does not cause problems due to footboard travelling as it requires two successive 'resets' to trigger a valid input.

The count information can be sent using 2-bits. It can specify whether the bus is half empty, few standees, or fully crowded.

This information is displayed by **multicolored LED** at the Bus stop device. Three different colors can be used to indicate the 3 different crowding conditions.

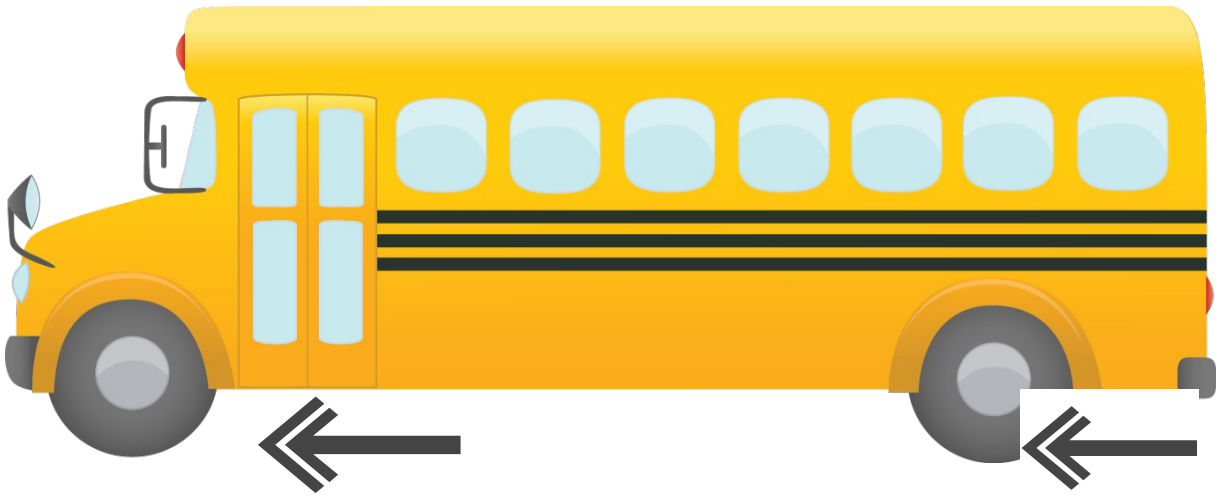

Illustration 3: PUSH BUTTON FRONT

Illustration 4: PUSH BUTTON REAR

Subsystem 1 (Bus Subsystem)
Arduino Board
Radio Transmitter
Push button switch

Illustration 7: GSM MODULE

Illustration 5: ARDUINO

Illustration 6: RECIEVER

Illustration 9: LEDs

Illustration 8: MULTICOLORED LED

Subsystem 2 (Bus Stop Subsystem)
Arduino Board
Radio Reciever
GSM module
LEDs

From Proposal to Prototype:

The prototype can be completed within about two months. We will work systematically by designing subsystem by subsystem, testing them individually and then finally integrating them. The timeline of working is attached at the end of the Document.

From Prototype to Product:

The Project should first start by procuring the components in bulk at wholesale prices. Then each system like the Bus stop meter and Bus subsystem should be fabricated separately. At the same time specially designed durable platic boxes should be designed and manufactured to house the electronics.

Once done the push button counting system can be built in to the steps of the buses by fixing the push button switches on the steps and then fixing a plywood board over them.

After there it is the job of fixing the modules in the bus stops and in the buses and giving the necessary wiring from the push button switches.

Tools and Components required:

Name	**Use**
Arduino	Overall controlling unit
GSM module	To communicate b/w bus stops
Radio Tx/Rx pair	To transmit and recieve data about bus

Push button switches	To detect the number of persons in bus.
LEDs	To display information

Bill for Materials:

Part	Quantity	Estimated Cost
Arduino Uno	2	1200
GSM module	2	2000
Tx/Rx pair	2	200
Push button swith	4	20
LEDs	10	30
Total		3500

Links for components:

http://www.inkocean.in/uno-r3-development-board-compatible-with-arduino?gclid=CPqHtKSmv8UCFVcNjgodegYASQ

http://www.icstation.com/433mhz-transmitter-receiver-arduino-project-p-1402.html#.U5mRFo1dURU

http://www.ebay.in/itm/like/331478931306?aff_source=Sok-Goog

http://www.rhydolabz.com/index.php?main_page=product_info&products_id=1099

Conclusion:

Thus from the above discussion it is apparent that the effect of the erratic MTC bus timings can be greatly reduced by implementing this smart bus system. People can save their valuable time and energy by knowing the arrival timings of the buses. The system is most accessible to all sections of the society. Unlike the various GPS tracking systems which necessitates the users to have a smartphone, this system does not impose any prerequirements on the users.

The system eliminates the need for human intervention in its working. Hence there is no room for errors and ambiguity due to human negligence or irresponsibility.

References:

http://my.metrocommute.in/

https://www.youtube.com/watch?v=U839NZ78EOo

http://en.wikipedia.org/wiki/Metropolitan_Transport_Corporation_%28Chennai%29

http://dssg.io/2013/08/02/why-bus-crowding-happens.html

Timeline:

Phases	**Progress**
Week 0	Purchasing components
Week 1	Designing Tx/Rx with arduino
Week 2	GSM module interfacing with arduino
Week 3	Linking two GSM modules
Week 4	Fabricating prototype for Bus and Bus stops
Week 5	Push button counting system
Week 6	Completing Bus stop meter meter using LEDs etc.
Week 7	Testing the system
Week 8	Demonstration to mentor
Week 9	Working on improvements
Week 10	Final submission

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