Smart Bus System for Specially Challenged Individuals

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Abstract. This paper introduces a system design about bus management system based on Wi-Fi module which implemented the basic functions of the intelligent public transport management system, such as monitoring the time of bus arrival, departing from the bus station and reporting stations name automatically. This system can ensure the punctuality of vehicles to run, improve the automation level of reporting stations, and quality of public transport service. The management system has low cost and thus it is more feasible. This System can be a brilliant helping hand for the individuals who are mentally and physically challenged and help them in reaching their respective destinations on time because, in our respective transportation system, the priority will be to drop the physically and mentally impaired individuals as well as senior citizens safely on time.

Keywords: Wireless Communication, RFID Reader, ESP8266, Cloud Platform.

1 Introduction

The mode of transportation through buses has increased since the pandemic and it is still a safer option than trains. Normally while in public transportation there is a lot of rush which gathers on the Bus Stops or Railway Stations. In these situations, those who are physically or mentally challenged and even senior citizens can't cope with the speed of normal people, to hop in the bus or train and people are not always kind enough to help them. So the creation of this Smart Bus System is basically to help the visually impaired people or the individuals who are physically or mentally challenged.

The main aim of this paper is to promote Wireless Communication. To promote Wireless Communication the best components which the authors could add to their paper are ESP8266 NodeMCU, RFID Tags and Detector and finally output would be displayed on the Cloud Platform to the Operator. The Cloud Platform displays the status of all bus stops and whether or not the bus has arrived at the bus stop. To indicate the arrival of the buses ON the bus stop the "LEDs" are used.

This can be proven to be a really effective system, as the dependency on humans decreases, the authors of this paper have brought up good alternatives to cover up all the man power with effective Wireless Communication. This system can also be in useful to normal passengers but the main priority will always be given to the specially challenged people.

1.1 Literature Survey

The idea of this paper is basically to create a transportation system and keep this transportation through bus prioritized for mentally and physically challenged people, senior citizens, and visually impaired people. D. Adhikari used Cloud Platform to inform the passengers regarding the arrival of the bus [1].

The application and functions of RFID used for reserving seats in transport system and announcements [2]. The NodeMCU is also used for Wireless Communication. The LEDs and buzzer system has been used by P. Herdiansyah for arrival notification of buses. This can act as a huge alerting method to display the impaired or challenged Individuals to understand if their respective bus has arrived or not [3]. The impact of RFID Readers and how accurate they are for detection can be seen in work proposed by M. J. Shah. The Importance of RFID Readers in Vehicles have been discussed. The RFID Reader is used to read the tag of the BUS, then the system will forward this data to the man agement [4].

The amazing system is developed where wireless communication has been used and the ESP8266 is used to convert the signal into data lines and NodeMCU ESP8266 is an integral part of the work developed by G. Suprianto [5]. A major understanding of how buses can be tracked is very well explained by A. Kumar Sharma [6]. The idea to track whether the bus has arrived at the bus stop or not so the implementation of a tracking system has been developed.

The real time data such as location, route, speed, list of passengers can be track and recorded by J. T. Raj [7]. RFID or GPS Technologies connected to a remote server over the Wi-fi Module such as ESP8266. With the help of Wireless Sensors, the alert systems in Smart Bus has been created. In this paper, the authors have mentioned

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that the Visually Impaired Individuals on the Bus Stop are provided with a mobile application recognized by GPS. Smooth the transportation executed with Wireless Communication by Manali and N.Z. Naqvi. They have executed the tracking system through a GSM module [8] [11]. An android application is used to display all the updates even system is in offline mode [9].The Arduino is used to control the GPS Modules to get the coordinates. This work also displays the major role of Arduino and how with the knowledge of C Language knowledge, any work can be handled efficiently [10] [12].

2 Operation of the Proposed System

The concept behind this work is a basic way to make travel easy for disabled people so the creation of a simple bus stop where the authors have put few buttons which are hosted as an indication to alert the bus driver to halt at a particular stop and then when the driver reaches the exact location an indication bell will indicate the person about arrival of the bus and now the person can board the bus for his destination. The process for this entire work starts with the bus moving from the bus depot to the route which has been assigned to the driver. If the driver gets the notification on its screen that he/she has to halt at some particular stop on their respective route then he/she will halt at that particular stop. Pick-up the passengers and move ahead to their next destination. This is the basic way the system will work.

The communication of the system with other devices is done with the help of a cloud-based service created. When the bus moves towards its assigned route the bus has a system fit inside it with an ESP8266 NodeMcu and an RFID reader which assists the driver at which stop he/she has to halt and will help to understand whether he/she has halted at the right bus stop or not.

This message from the bus depot server will go the driver that the bus has stopped at the right bus stop or not if not the driver gets the notification that, 'Driver has missed the bus stop'. The RFID Card will be installed on each bus stop to know about the particular Bus stop. Here the bus has to be halt when the bus reaches that bus stop. The RFID card is installed at the bus stop and RFID reader in the Bus, will read the RFID Signal and then send it to the ESP8266 Data line. The data line will create a signal and send it to the cloud-based server that the bus has attended the flag host calls of the disabled people from the different bus stops and has a successful journey on defined route. This complete system is visually depicted in Figure.1.

2.1 Block Diagram of the System

Power Supply (for BUS): The power supply block in the diagram is the power source for the system which step downs the voltage from 230V to 5V as essential power required for the system. After the voltage is stepped down to 5V, it is further transferred to the other blocks of the system.

Microcontroller (for BUS): The Microcontroller block consists of the ESP8266 WiFi module chip which

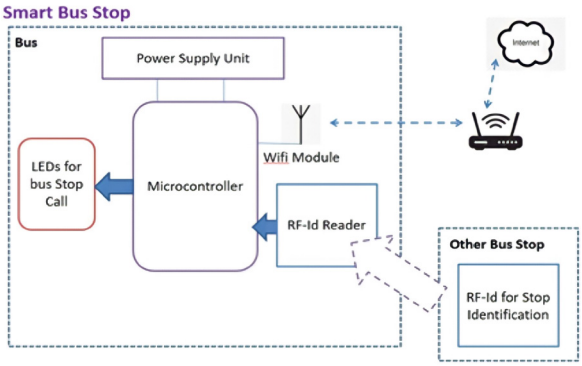

Figure 1. Block diagram of the bus

acts as a communication device between the cloud server and also communicates with the Bus and the Bus Driver with the help of the cloud server data. The Microcontroller controls the functioning of the Bus data and the Bus system.

RFID Reader: The RFID Reader in the system communicates with RFID cards which are placed at the flag host pole on the Bus stops which gives the information that the particular bus has received the particular passenger from the particular bus, and after the entire process it gives the signal to the microcontroller to send it to the cloud server. After the process is done then only the bus moves further to its next destination.

LEDs for Bus Stop call: This LED's give the information to the bus driver to stop at the particular bus stop to pick up the passenger from that stop who is specially challenged passenger who has sent a notification to the particular bus he wants to board it and wants to reach his destination. This way the LED block works in the system.

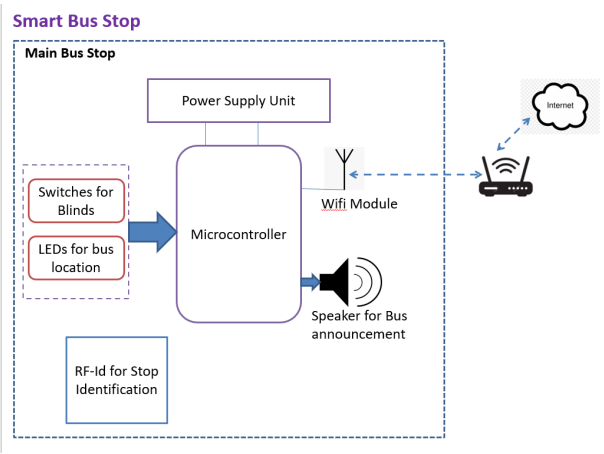

Figure 2. Block Diagram of System Created for Bus Stop

Power Supply (for BUS Stop): The power supply block in the Figure 2 is the power source for the system which step-downs the voltage from 230V to 5V as essential power required for the system. After the voltage is

stepped down to 5v then it is further transferred to the other blocks of the system.

Microcontroller (for BUS Stop): The Microcontroller block consists of the ESP8266 WiFi module chip which acts as a communication device between the cloud server and also communicates with the Bus and the Bus Driver with the help of the cloud server data.

Here they also have an interaction with the pushbuttons which have information of the bus beside them which helps the specially challenged people to board at the right bus which can help them to reach their particular destination. They have also LED's near the push button to know that they have pressed the right button. And the buzzer system is also available which helps them to get notifications about the bus when it reaches the bus stop so that they can board their particular bus to reach their destination.

An RFID card is paced with the push button at the flag host pole near the bus stop with the bus stop identification card which is RFID based.

2.2 Hardware and its functions

In this Smart Bus System the first hardware instrument is RFID Tags. These RFID Smart Cards would be installed on all the respective smart bus stops. The RFID Card Reader will be reading these cards. The role of RFID Card Reader and Detector plays a crucial part in this system.

When the bus arrives at the bus stop, it will detect the RFID card, it delivers the message to the ESP8266 NodeMcu data line, that the bus has arrived at the bus stop. Arriving to the next equipment is ESP8266, The ESP8266 NodeMcu data line will create a signal and send it to the cloud-based server that the bus has attended the flag host calls of the disabled people from the different bus stops and has a successful journey on his defined route. Also another part of a hardware unit is Buzzer.

The buzzer is used in our system to alert disabled individuals about the arrival of the bus. Especially the individuals who are visually impaired will be alerted that their bus is arriving and they can get ready to enter the bus. It can be used as an alarm for visually impaired individuals.

Coming to next part of the Hardware is LED'S. There are LED's attached to the system as well. When the bus arrives at bus stop no 1, LED1 will glow and when the bus will arrive at bus stop no 3 the LED 3 will glow and similarly for other bus stops as well.

2.3 Software used and its functions

Arduino IDE is the software for Arduino. It is a text editor like a notepad with different features. It is used for writing code, compiling the code to check if any errors are there and uploading the code to the Arduino. It supports C/C++ language.

It is open-source software, where the user can use the software as they want it to. They can also make their own modules/functions and add them to the software. Not Exactly a Software but an Cloud Platform is used in this Work to notify the operator whether the bus has arrived at the stop or not.

Cloud Platform is where the final data is received. The Cloud Platform keeps the operator updated on the situation regarding the buses. So the cloud platform is a link between the buses and the operator.

2.4 Connection Diagram

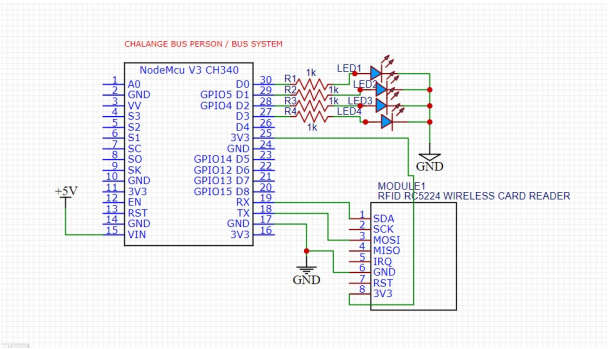

Figure 3. Connection Diagram of Bus

In this circuit the authors have used ESP8266 as the brain of the entire system and RC5224 RFID Card Reader as the heart of the system. Bus Depot with Complete System is clearly shown with Wiring Components in Figure 3 and Figure 4.The RC5224 has a major role in the entire system after the ESP8266 because it helps to collect the data from the bus stops and to send it further to the Bus Depot.

Where RC5224 is placed at the wind screen of the bus and the RFID tags are placed at the bus stop poles where both RFID Card and RFID Card Reader can interact and match their data and verify with the help of cloud server and ESP8266 . The ESP 8266 is also connected with few bus stop where they can get the info of the specially challenged people which gives the bus driver the exact notification of that person and that bus stop which may assets both person on the bus stop and the bus driver to get the exact information of each other . This way the entire Bus System works in the bus with interface of ESP8266 and RC5224 .

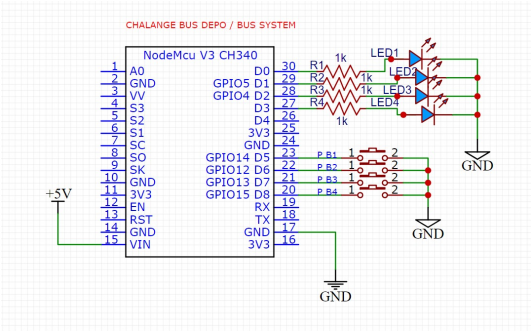

Figure 4. Connection between Bus Depot and Bus System

In this entire circuit an ESP8266 WIFI chip is used which is the heart of the entire system mainly it interacts

here with the cloud server and the push buttons. The process starts when the push button is pressed from a certain bus stop location by specially challenged person , it send the signal to the cloud server and after the signal is reaches the cloud server the info of that bus stop is displayed on the cloud server .

This entire cloud server of each bus can be monitored from a single place such as the bus depot. After the interaction of the cloud server is then there will be an interaction of an led blinking at the bus stop and a buzzer notification at the bus stop to let the know that specially challenged person has press the button for the bus driver to pick him from the location and help him to reach at his destination. This way here the circuit at the bus and the bus stop works with the interface of the ESP8266

2.5 Implementation Methodology

The process to implement the entire system is with the help of the ESP8266 , RFID Cards, RFID reader, LED's, etc. These elements can make a management system for the challenged people to make their travel easy and convenient and they can reaches their destination safely and easily. The implementation of this entire system is less complicated but working of system on Cloud platform with Wi-Fi network is challenging task which is the major point and the much essential way of transport necessary of the challenged people.

The system instillation starts with the process of the implementation of the bus stop at the different location for the challenged people. This bus stop contains a **braille script** which informs the blind people with the information of the bus and bus number and a push button which will be indicate in the front of the bus number and the braille instruction sheet where he can push the button and give the info to the specific bus and the bus driver to stop at the particular bus stop.

The bus driver will also get the LED notification of the bus stop where the challenged person is at the particular bus stop. After the driver gets the notification the bus moves towards his pickup and then the driver reaches the bus stop. An RFID reader is placed on the windscreen of the bus and the RFID is paced at the pole of the bus stop as shown in Figure 6 and Figure 7. The RFID reader reads the bus stop data and send a signal to the bus stop buzzer which gives an indication to the special challenged person if he is deaf he gets an blinking LED notification on the bus stop board where the challenged person gets to know that his bus has been arrived and he can board the bus.

The RFID reads the RFID card at a 100 meters of the distance of the bus stop. So the challenged person can get ready to board the bus and start his journey for his destination where he has to reach. After boarding the bus the person will be questioned for his destination and the bus attendant will record to start journey of passenger and when he reaches his destination he get an notification one stop before his destination stop that, 'The destination is going to arrive soon' and the person should be ready to be abort from the bus . There is also an online stop navigation for the bus to know whether the defined person has entered the bus or not. If not he will get notification from the depot and if bus is canceled due to some issues the LED on the bus stop will not glow.

3 Result

Here the creation of a website is done, that displays to the operator whether the bus has arrived at the bus stop or not and otherwise the bus has departed from the respective bus stop. As seen in the image when it's time for the bus to arrive at the bus stop.

A Call signal is sent to the bus to reach the respective bus stop. So accordingly when the bus driver receives a message from the operator the bus driver departs with the bus to reach the bus stop.

On the Server you can be seen the status of the Bus whether it has arrived on the bus stop or not. If the bus is arrived on the bus stop a message will be dropped on the server "Done".

When the bus driver picks up the passenger from the bus stop, the status "Done" is displayed on the server as shown in Figure 5.

4 Conclusion

This paper of Smart Bus Systems will provide a huge benefit to the mentally and physically challenged individuals as well as the senior citizens. They can travel accordingly to their comfort and with the help of RFID Detector and RFID Smart Cards, the passengers waiting at the bus stop can also be alerted of the bus arriving at the bus stop. A Buzzer is used in the system to alert the passengers at the bus stop. In the future, the system can also be updated with an LCD screen to alert the passengers of the buses arriving and departing from the bus stop.

5 Future Scope of the Paper

The safety for physically impaired and mentally impaired people will be high. They will be dropped off to their destination without any hesitation. The whole process of this work can be carried through Wireless Communication. The Demand of Wireless Communication will increase in the future.

The operator and the bus driver of this Smart Bus System will be available for their safe and smooth transportation. This Smart System can be a great alternative for them rather than traveling with the general public in huge numbers. In coming years the injuries and accidents of visually or physically impaired or mentally impaired individuals also would drop down.

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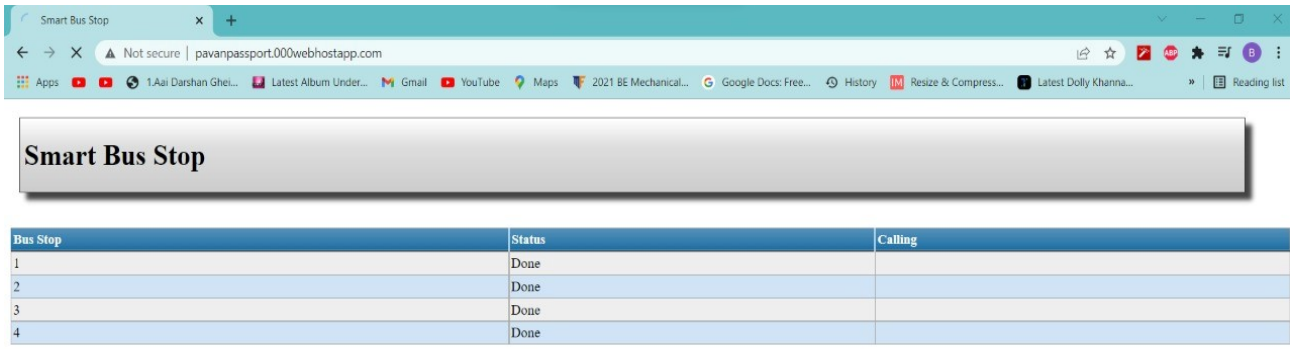

Figure 5. Web Page Showing the Information of the BUS and its BUS Stop

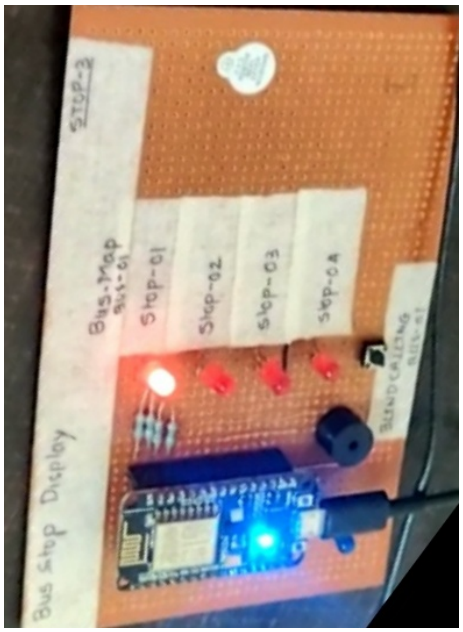

Figure 6. Implementation of the system near the BUS DEPOT

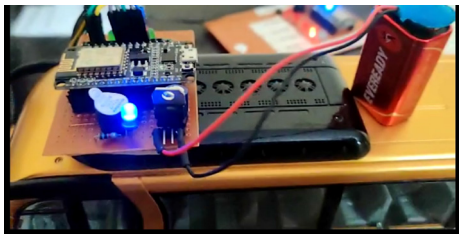

Figure 7. Installation of RFID Reader on each BUS

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