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Smart Bus System Using IoT

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Abstract: In this paper we discussed about "Smart bus tracking system" which aim to betterment of people and customer satisfaction which is fulfilled by this system. Such a big percentage of public is travelling by bus transport in India and the biggest problem these people are facing is related to the time table of buses and availability of seats in the bus. Either the buses are not on time or the seats are not available in the bus. In addition to this the control room are unaware of live location of the buses so they can't predict the exact arrival time of bus at specific depot and neither do they have any information regarding the vacant seats.

Keywords: GPS (Sim808), Arduino UNO, RFID, ESP8266

I. INTRODUCTION

The major population of India travels by buses and trains, for the long travelling distance most of people prefer train and for shorter and medium travelling distance they prefer bus, even today due to the awareness policies like "save earth" and "go green" evolutions people are motivated to use the public transport, but the major problem of the public transport is the in convenience to passengers due to irregular timing of buses, unknown current status of buses, so the motivation of the project is the convenience of the people in the field of public transport. solving the problem by using GPS, Seat counter, ticketing scheme is our main project idea.One may say such system is available but the major problem with available unit is either their cost is high or the whole system is not available in single unit.So providing the whole system in single unit is main purpose of project and also at the affordable price.With the help of above system, we get current location of bus the using (GPS+GSM(808)), Infrared module gives the total number of vacant seats in bus, and RFID cards provide new ticketing scheme

II. LITERATURE REVIEW

Buses are the important mean of the public transport in India; Due to this social significance urban and rural bus transport is often owned and operated by public agencies under government and also private agencies.The National Sample Survey Office (NSSO) and Ministry Of Statics and Program Implementation (MoSPI) The survey covers both rural and urban area in India .According to NSSO report; buses are the most preferred mode of transport in both urban and rural areas in India.Such a big percentage of public is travelling by bus transport in India and the biggest problem these people are facing is related to the time table of buses and availability of seats in the bus. Either the buses are not on time or the seats are not available in the respective buses In addition to this the control room are unaware of live location of the buses so they can't predict the exact arrival time of bus providing the current position of buses, at specific depot and they have no information regarding the vacant seats, So number of available seats, The newly introduced ticketing scheme to the passengers may motivate them to use the public transport system is the view of doing the project.

III. SYSTEM DESIGN

The below block diagram is of the smart bus system that gives the information about the live location of the bus, number of passengers sitting inside the bus, next station of the bus on a single click with the help of the IOT system and following is the brief information of every blocks

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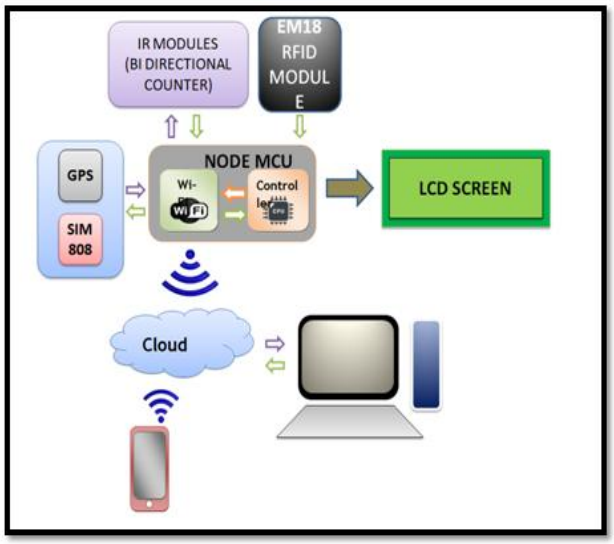

Fig 1: Block diagram of system

A. System Specification:

1. **EM-18(RFID module)**

The em-18 is the RFID receiver, whenever RFID card is swiped on em-18 the em-18 will first identifies the card. Then it sends that information to the controller then the controller will send the information over the IOT to cloud so to detect and identify between the different RFID card the em-18 is used.

2. **IR-modules**

The bi-directional IR sensors are used to find the vacant seats in the bus, 2 sets of IR sensors are fitted on the door of every bus whenever the 1st IR sensors detects and then the 2nd sensor detects it indicate the entry of the passenger while when 2nd sensor detects and then 1st sensor detects it indicate the exit of the passenger.

3. **SIM 808 and GPS**

For showing the live location of the bus the GPS module is used with accordance of the latitude and longitude. Once it finds out the exact
Co-ordinates of the bus then with the help of controller the co-ordinates are passed over to the cloud.

4. **NODE MCU**

The node MCU is the controller and the WIFI module, the processor is
L-106(32bit RICS) and the WIFI module is esp8266 the work of the processor is to work on the data that is sent by the different sensors and the WIFI module basically sends the processed information over the server (IOT)

5. **LCD screen**

The liquid crystal display is the 20x4 used to notify the passengers about the next station.

6. **Cloud**

The cloud used is the Ubidots the information collected by processor is sent by the node-MCU to the Ubidots

7. **Mobile and web**

The information is sent to Ubidots and anywhere from the world we can easily access the information in the format of the visuals

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IV. FLOW CHART OF SYSTEM

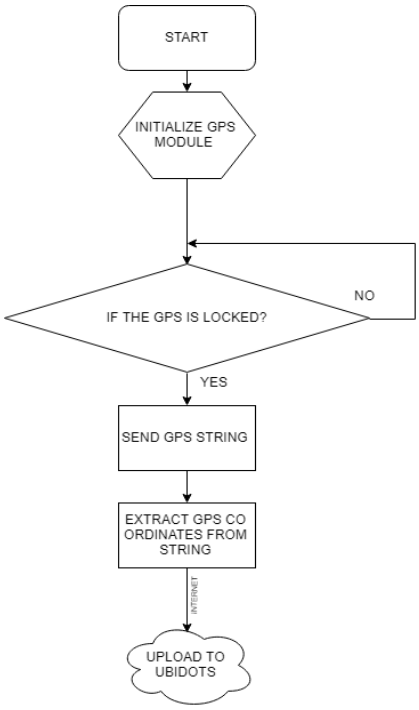

Figure 2: FLOW CHART OF GPS

From the algorithm we will come to know how FLOW CHART of the GPS system works with all possibilities. First when power supply is given to the GPS. The GPS module will initialize itself, then the module will lock the co-ordinates, but if the co-ordinates are not locked then the module will initialize again, once the co-ordinates are locked then the complete string of GPS including latitude and longitude are passed to the server in the respective format with the help of the controller and esp8266 then at Ubidots the latitude and longitude are extracted and using the visual map application in Ubidots we can see the live location of the bus in the Google map.

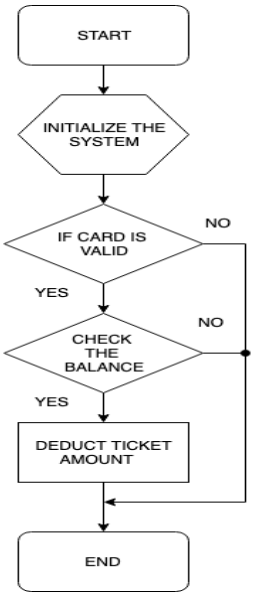

Figure 3:.FLOW CHART OF RFID.

From the algorithm we will come to know how the RFID system works with all possibilities. When the power supply is given to em-18 the module will start, Em-18 is the RFID receiver module it radiate the energy and when the RFID comes in contact with that energy the card will absorb that energy and sends the signal back to em-18 using the radiated

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energy, so when any card comes in contact with any card then card will send signal to em-18,then with the help of controller we can decide whether the card is valid or not if the card is not valid then we will show "invalid card" on the LCD, when we identifies the card is valid then we check if the card is having sufficient balance on card if yes then the fair of the bus will be deduced from the balance ,but if balance is less than fair amount then the "insufficient balance" will show on LCD screen.

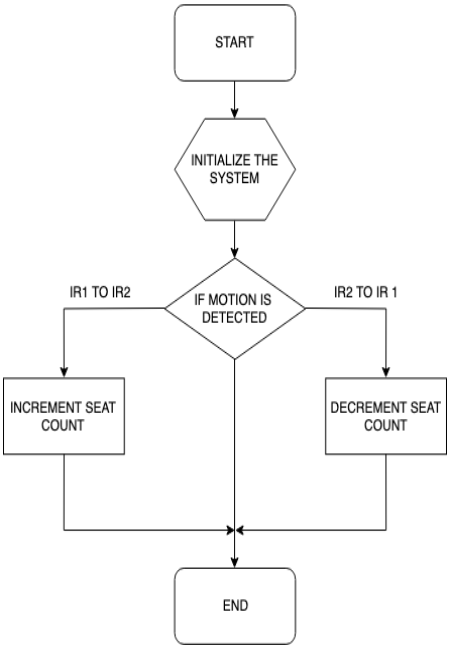

Figure 4: FLOW CHART OF Seat counters.

From the algorithm we will come to know how the IR system works with all possibilities, When the power supply is given to IR sensors the module will start, once the supply is on the sensors will start to sense the motion the ir uses the phenomenon of infrared to detect the motion, for the count of vacant seats in the bus we use the bi-directional IR sensors that is 2 IR sensors. Once the IR detects the motion it gives output, so when IR 1 detects motion and then IR 2 detects motion it indicates the entry of passenger and when the IR 2 detects motion and then IR 1 detects motion it indicates the exit of the passenger and we will show the count of vacant seats in the bus on the LCD screen.

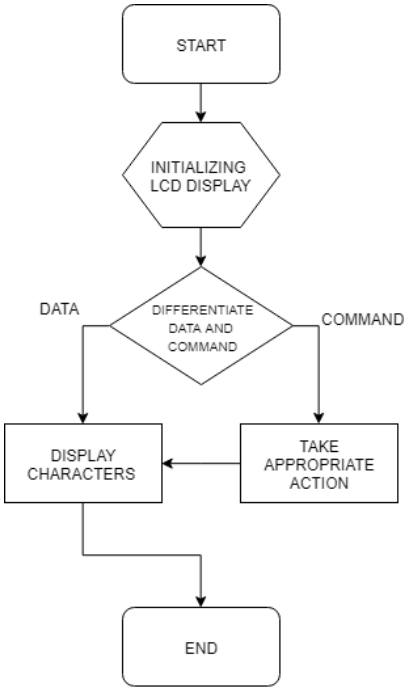

Figure 5: LCD DISPLAY

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From the algorithm we will come to know how the LCD works with all possibilities, once the power is given to LCD and when the controller gives the data to be show on the LCD, the LCD will show the characters which we give in the form of the ASCII code.

V. IMPLEMENTATION

A) HARDWARE IMPLEMENTATION

For the entire assembly of project smart bus system, we have used plastic box for enclose the entire system. To assemble all modules on single plane we have used acrylic sheet. The proposed system consists of following hardware.

1. Node MCU (Micro controller).
2. SIM 808 module.
3. RFID Reader module.
4. IR module.
5. LCD display

The main device in the system is micro controller who takes all the decision and controlling actions, remaining other modules are communicate with the controller.

1. Connection between NODE MCU and SIM 808

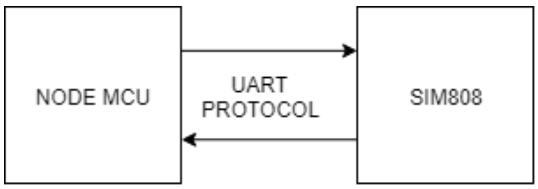

Figure 6: Node MCU and SIM 808

As shown in above figure we have used UART protocol for communication between controller and sim808. During the programming we assign software serial port on the node mcu. In the uart protocol 3 pins are used; pin names are as follows TX (transmitter), RX (receiver) and GND (Ground). The ground pin of both the modules is shorted. The TX pin of MCU is connected to RX pin of module SIM 808, and vice versa.

2. connection between NODE MCU and RFID Reader

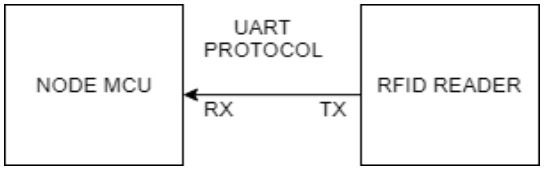

Figure 7: Node MCU and RFID Reader

For the communication between MCU and RFID Reader we have used UART protocol. This is a unidirectional communication because only the RFID module sends data to the NODE MCU. The TX pin of module is connected to the RX pin of MCU and the ground pins of both the devices are shorted.

3. Connection between NODE MCU and IR modules.

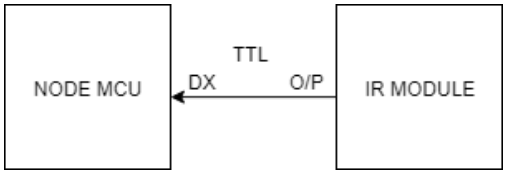

Figure 8: Node MCU and IR module

The IR modules give output when the sense motion in front of IR sensor pair. The outputs are in the form of high and low voltage levels. if the sensor sense the motion it will send signal to the digital pin of NODE MCU controller. The IR sensor has 3 pins VCC, GND, output.

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4. Connection between NODE MCU and LCD display

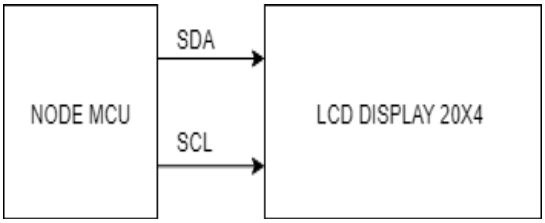

Figure 9: Node MCU and LCD display.

The LCD has 16 pins out of the 8 pins D0 to D7 are data pins and pin4, pin5 and pin6 are control pins. On the node MCU board we have limited pins, for reducing the connection we connect i2c module to LCD now we communicate to LCD using i2c protocol. In the i2c protocol it has only 3 pins SDA (Serial data) , SCL (clock pulse) and GND.

B) SOTWARE IMPLEMENTATION

1. Arduino IDE:
We have used Arduino IDE for the programming and the output window is as follows.

GPS serial monitor window

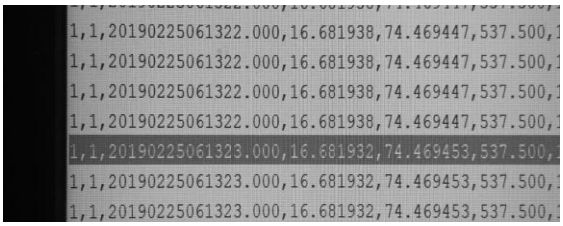

Figure 10: String given by SIM808.

This is the serial output window of the GPS it is showing the complete string from the SIM 808.The string is containing the information in the sequence of year, month, date, latitude, longitude.

1) Red colour box defines the year, months, date.
2) Yellow colour box defines padding.
3) Orange colour box defines the latitude and longitude.

2. RFID system:
Output of RFID system is displayed on Serial monitor. The output results are as follows.
1. Invalid card
2. Insufficient balance
3. Balance deduced LCD or serial monitor

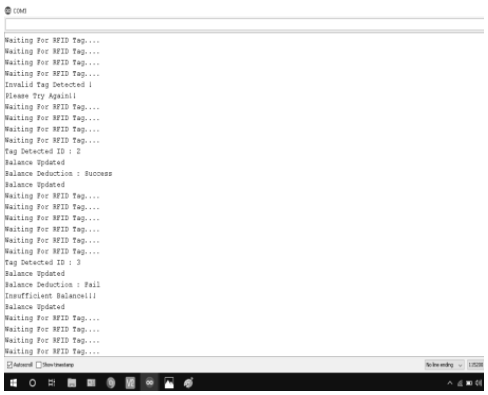

Figure 11. Output of RFID system is displayed on Serial monitor

1) when the card swiped is not registered then the first case of the invalid card displayed on Serial monitor

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2) When the card swiped is not having the sufficient balance then second case of the Insufficient balance displayed on Serial monitor.
3) When the card swiped is valid and having sufficient balance then third case displayed on Serial monitor.

3. Ubidots main window:

This is a web page of ubidots, showing dashboard equipped with map, seat count, balance.

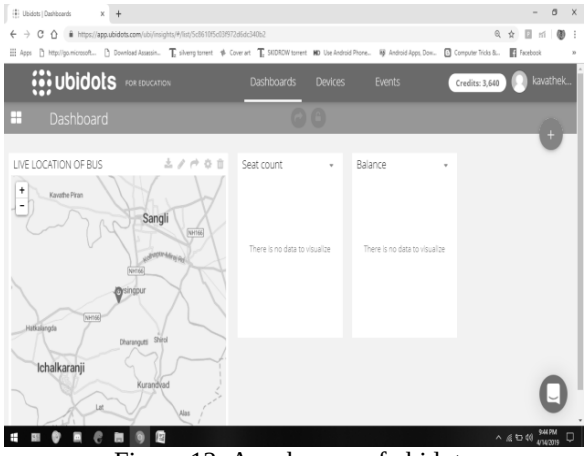

Figure 12. A web page of ubidots

1) GPS map: - This will show the live location of the bus by the pin point on the Google maps.
2) Seat count: - This will show total vacant seats in the bus.
3) Card balance: - This will show available balance on the card.

VI. SEQUENCE

1. The sequenced working of the project is as follows,
2. Initially when we gives power supply to complete system the whole system initializes, the GPS system will start to send the co-ordinates to server of Ubidots,
3. If the Em-18 detects the card then it will check balance, validity and other parameters.
4. At first the vacant seat count is full, and then once the passengers start to enter the bus the vacant seat count decreases for every entry by one.
5. The LCD will show the valid entry, invalid entry, next station information when specific events occurs

VII. RESULTS AND DISCUSSIONS

Folowing is a screen shot of the system implemented.It displays the entire system. we can see current location of bus on the website of UBIDOTS as well as on the android aplication on the mobile phone.

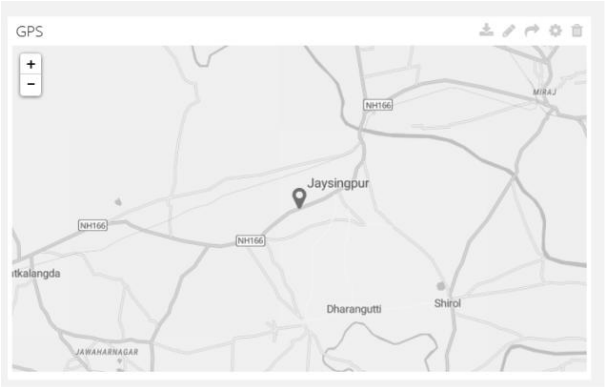

Figure.13. live location on the Google map

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VIII. CONCLUSION

This proposed work is successfully designed, implemented and tested. Our system reduces the waiting time of remote users for bus. With the webpage we can track the location of bus at any point of time. All the current information is stored to the cloud and it is retrieved to remote users via webpage this system is more user friendly for users to get information visually shown on Google Map. User can use the webpage for real time tracking of bus which provide interactive interface environment. So, by using this webpage remote user can just wait or they may reschedule their journey according to the availability of bus. Thus, by implementing this project, a greater complexity of the problems faced by common people can be reduced. As it uses no usage of paper due to the use of RFID ticketing system, even the deforestation can be prevented and thus be saving our mother nature.

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