Autonomous Bus To Avoid Covid-19 Pandemic Situation

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Abstract- *Under existing legislation, people using public transport, they are encouraged to keep a social distance of at least one meter and to wash their hands in travelling. In this project we focus to avoid the Congestion, maintain social distance between passengers on bus transportation. Another crucial preventive measure is to sanitize passenger hands while commuting.we present a motion-planning framework that leverages expert bus driver behavior, increasing the safety and maneuverability of autonomous buses. Autonomous vehicles will increase the safety, quality, and efficiency of transportation systems. However, to deploy this technology in urban public transport, many challenges related to self-driving buses still need to be addressed. Unlike passenger cars, buses have long and wide dimensions and a distinct chassis configuration, which significantly challenges their maneuverability. To deal with their special dimensions, we introduce a novel optimization objective that centers their whole body as they travel along a road. Smart Bus Fare Collection System also implemented using touch less smart ticket card Technology, which will deduct the passenger's fare according to the distance travelled. Compared to the existing ticketing system, Touch less smart ticket cards are more convenient and reusable. Gives firm assurance to both passenger and Public Transport System (PTS) about the transaction.*

Keywords- Arduino, Microcontroller, Sensors

I. INTRODUCTION

Due to the novel coronavirus (SARS-CoV-2), the traveling capacity of a public bus is considerably reduced because of the need for a social distance surrounding the radius of each passenger within the bus. A report released by European Union Aviation Safety Agency (EASA) in May 2020 states that, ``Where buses are used in the public services, an increased quantity should be considered in order to accommodate for physical distancing inside them".

In consideration of the passengers' safety during COVID-19 outbreak, a series of distancing norms have been issued by transportation associations and with regard to social distancing when passengers are inside the buses. The public Transport Authority, Medical Advisory Group recommends: a minimum distance among passengers that can range from one to two meters. In addition, we have given a smart card for the passengers along with their details. The passengers can use the smart card to buy the tickets. Once the ticket is issued the seat allotment of the passengers also can be detected and the system also has automatic sanitizing mechanism which will allow the passengers to sanitize their hands while entering in the bus. Research on autonomous vehicles is growing tremendously. The majority of relevant research studies has been focusing on autonomous cars, neglecting what seems to be the more environmentally friendly version of autonomous vehicles: the autonomous buses Autonomous buses – also called self-driving or driverless buses or automated shuttles – are being tested with pilot projects in several cities world wide At the same time, technology is being developed aiming to reach higher automation levels. Early studies on the use of autonomous buses indicate positive attitudes among users and feelings of safety and security during the ride. The few existing studies have been conducted in areas including a university campus, an office campus, and a small village. At present we have bus pass and paper-based ticketing system for the convenience of the passengers issued by the transport corporation. In this system, there is chance for COVID-19 pandemic spread situations. The passengers should wait in long lines to get a monthly bus pass which is very time consuming. So that the virus can spread easily. In paper-based ticketing system, there is a possibility of pandemic spread among passengers and conductor. In order to overcome above mentioned problems, we proposed an advance system using microcontroller and sensor systems.

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II. LITERATURE REVIEW

In the title [1] Evaluation of Boarding Methods Adapted for social Distancing in the Public Transport Safe during covid-19 proposed by R. John Milne, Camelia Delcea. Social distancing reduces the risk of people becoming infected with the novel corona virus (SARS-CoV-2). When passengers are transported from an airport terminal to an airplane using apron buses, safe social distancing during pandemic times reduces the capacity of the apron buses and has led to the practice of airlines keeping the middle seats of the airplanes

unoccupied. This article adapts classical boarding methods so that they may be used with social distancing and apron buses. We conduct stochastic simulation experiments to assess nine adaptations of boarding methods according to four performance metrics. Three of the metrics are related to the risk of the virus spreading to passengers during boarding. The fourth metric is the time to complete boarding of the two-door airplane when apron bus transport passengers to the airplane. Our experiments assume that passengers advancing to their airplane seats are separated by an aisle social distance of 1 m or 2 m. Numerical results indicate that the three variations (adaptations) of the Reverse pyramid method are the best candidates for airlines to consider in this socially distanced context. The particular adaptation to use depends on an airline's relative preference for having short boarding times versus a reduced risk of later boarding passengers passing (and thereby possibly infecting)previously seated window seat passengers. If an airline considers the latter risk to be unimportant, then the Reverse pyramid Spread method would be the best choice because it provides the fastest time to board the airplane and is tied for the best values for the other two health risk measures.

In the title [2]Intergrated Navigation and Distributed Control Intelligent Transport System proposed by Sergey Brodsky, Alexander PanferovOptimization of vehicle traffic is one of the most important problems of modern civilization.A satisfactory solution of this problem has not yet been achieved. A successful solution can only be obtained usingthe latest advances in navigation, communication, control and computer technologies. The article offers new methods for modeling, simulation and optimizing control systems of an integrated intelligent transport system by regulating the parameters of the transport network and directing the movement of individual vehicles. Methods of managing a complex intelligent transport system as a dynamic system of variable structure with distributed parameters are considered.

In the title [3]Floating Buses: Dynamic Route planning and Passenger Allocation based on Real time Demand proposed by Conor McKenna, Siobhan Clarke Traditional bus systems cannot adapt to the dynamic and ever changing demand for public transport in the cities because of their strict timetables, static stop locations and constrained capacity. These systems increase the emissions as buses have to make unnecessary journeys dictated by their fixed route plans and travel with empty seats as a result of their pre-planned timetables. To address these issues and offer more convenience to passengers, this paper presents a Floating Bus system that plans journeys based on passengers' real-time demand. This system allows the passengers to request a ride from their location, it then aggregates a number of requests, appoints the most convenient stop for the passengers, and allocates a bus to complete the journeys. Results show that the Floating Bus system increases passengers' convenience by appointing dynamic bus stops, decreases the emissions and passengers' travel time by dynamic route planning**.**

In the title [4]Internet-of-things based Smart local transport Management System proposed by Vishal Pawar, Nilesh P Bhosale.The Internet of Things (IoT) is a state of art paradigm that makes any electronic apparatus as part of the Internet atmosphere. IoT is about mounting sensors (RFID, IR etc.) for everything, furthermore, interfacing them to web through protocols for data exchange and communications, to attain smart recognition, location tracking, supervising and controlling. In current work, we invented a novel IoT based framework to develop Smart Local Bus Transportation System (SLBTS). The proposed system comprises of electronic device that is located in the moving public vehicle which provides real time data, a cloud server that absorbs this data, application software installed at bus depot and a mobile application for commuters travelling in buses. The devices gather substantial amount of information like number of passengers travelling, vehicle speed, fuel level, engine temperature and being connected to internet the collected information is synched up with cloud server to convert it into some useful data. Passengers in turn can check the status of bus on mobile app by entering bus number.The current work, realizes the full potential of IoT, also discourses its several challenges and advances the conceptual solutions to tackle them.

In the title[5]Smart City Bus Application with QR Code A Review proposed by Sim Liew Fong, David Wui Yung Chin, Rabab Alyaham Abbas. Smart City Bus Application with QR Code is an Android application that provides bus information in real-time in Malaysia. It uses the commonly available function on any modern Android device such as the Global Positioning System (GPS). Other than that, Smart City Bus Application also provides many functions mainly QR code payment that might be useful for the public generally to make payment without using cash or card. This review paper brightens the idea of the application in a much simpler way.

III. METHODOLOGY

The proposed system emphasizes the automatic ticket generation and improvement of bus pass renewal procedure. This system is developed to avoid the Congestion and for maintaining the social distance. This proposed system identifies the passenger who wear the mask or not by using python image processing technique. If the passenger didn't wear mask, then they will not be allowed inside the bus. RFID

Reader and tags used for ticket and bus control process. Temperature sensor is used to monitoring the passenger's body temperature. Touchless Hand sanitizer mechanism will help to sanitize hands of passengers. DC motor is used for bus engine mechanism. IR sensor used for passengers counts. Every status will be display on LCD.

OBJECTIVES:

- Only limited passengers are allowed through the IR sensor i.e., 26 passengers
- To maintain a social distance of approximately 2 meters each individual.
- To detect whether the passengers are wearing the face mask or not using image processing method.

BLOCK DIAGRAM

In this Proposed system we use ARDUINO UNO microcontroller which act as brain of the system, because the entire system program instructions stored in it. Infrared sensor is used for counting the passengers and also humidity sensor

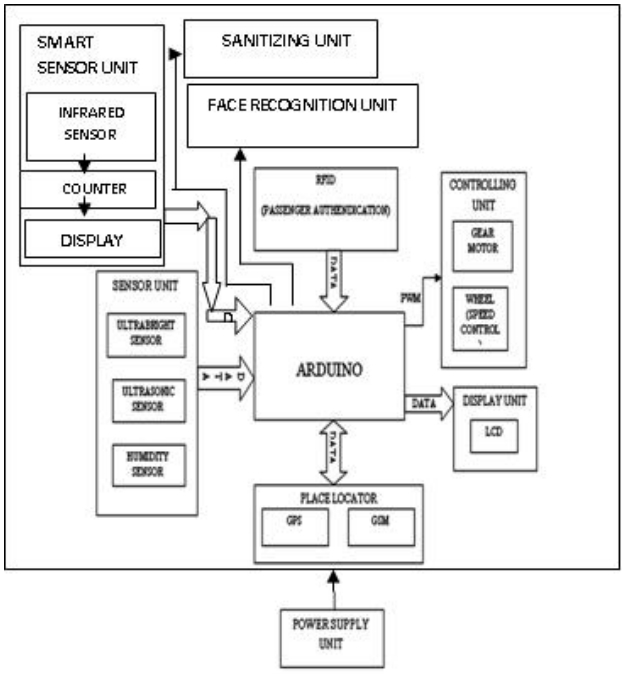


Fig. 1 Block diagram of Autonomous Bus

detects the temperature. Touchless Hand sanitizer mechanism will help to sanitize hands of passengers. Ultrasonic sensor is used to measure distance between the individual. The location is identified using GPS and GSM. Facemask recognition is done using image processing method.

The details of the hardware and software required for this project are given below;

Hardware Requirements Software Requirements

Microcontroller MPLAB IDE/
Thermal sensor Arduino software IDE
IR sensor Embedded C
Driver Circuit Python IDLE
Solenoid valve
Power supply +5V dc
LCD
RFID
Buzzer
Ultrasonic sensor-HC-SR04

IV. HARDWAREDESCRIPTION

ARDUINO UNO

Arduino is an open-source project that created microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers. These systems provide sets of digital and analog input/output (I/O) pins that can interface to various expansion boards (termed shields) and other circuits. For programming the microcontrollers, the Arduino project provides an integrated development environment (IDE) based on a programming language named C and C++. Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter.

POWER SUPPLY

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

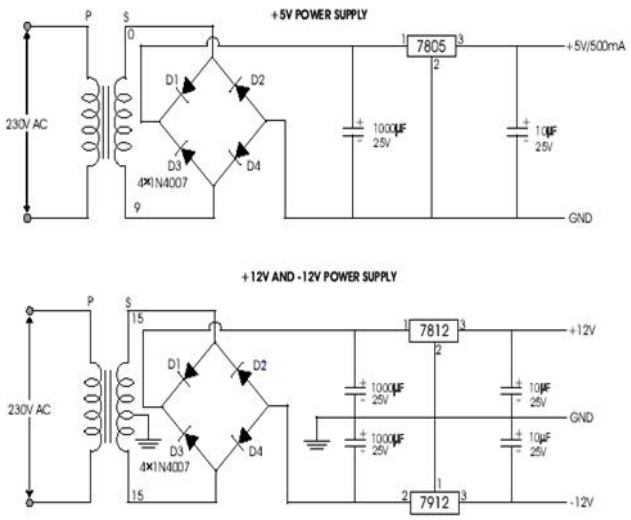


Fig.2Circuit Diagram

LCD

LCD stands for Liquid Crystal Display. This is an LCD Display designed for E-blocks. It is a 16 character, 2-line alphanumeric LCD display connected to a single 9-way D-type connector. This allows the device to be connected to most E-Block I/O ports. The 16 x 2 intelligent alphanumeric dot matrix display iscapable of displaying 224 different characters and symbols. This booklet provides all the technical specifications for connecting the unit, which requires a single power supply (+5V).In this project, LCD displays all messages.

Fig. 3 16X2 LCD

DC MOTOR

Geared dcmotors can be defined as an extension of dc motors.A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM.The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. A DC motor can be used at a voltage lower than the rated voltage. But, below 1000 rpm, the speed becomes unstable, and the motor will not run smoothly.

Fig. 4DC Motor image

ULTRASONIC SENSOR

If people need to be detected, a sensor should be used that has an operating scanning range that is considerably greater than the required measurement distance. The greater the operating scanning range, the lower the ultrasonic frequency. Ultrasonic sensor is used to measure distance between the individual for maintaining the social distance.

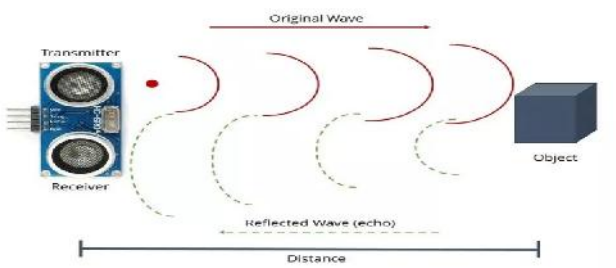


Fig.5 Ultrasonic Sensor process

BUZZER

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances and sounds a warning in the form of a continuous or intermittent buzzing or beeping when mismatch occurs. Here, if the body temperature is too high and also the distance decreases between each and every passenger, the buzzer starts alarming.\

Fig. 6 buzzer

SOLENOID VALVE

The infrared sensors of the automatic hand sanitizer dispenser detect the infrared energy that is emitted by one's body heat. When hands are placed in the proximity of the

sensor, the infrared energy quickly fluctuates. This fluctuation triggers the pump to activate and dispense the designated amount of sanitizer.

Fig.7 Hand Sanitizer

RELAY

A relay is an electromagnetically operated switch and made up of an electromagnet and a set of contacts. Relays control one electrical circuit by opening and closing contacts in another circuit. Relays are found hidden in all sorts of devices.

RFID READER

A Radio Frequency Identification Reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio Frequency waves are used to transfer data from the tag to a reader. The RFID tag it must be within the range of an RFID reader, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items.

Fig.8 RFID Reader

IR SENSOR

IR LED emits infrared radiation. This radiation illuminates the surface in front of LED. Depending on reflectivity of the surface, amount of light reflected varies. This reflected light is made incident on reverse biased IR sensor. The amount of electron-hole pairs generated depends on intensity of incident IR radiation. Thus, as intensity of incident ray varies, voltage across resistor will vary accordingly. Infrared sensor is used for counting the passengers.

Fig.9 IR Sensor

TEMPERATURE SENSOR

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. This detects the body temperature of the passengers.

Fig.10 Temperature Sensor

DRIVER CIRCUIT:

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas discharge), line drivers, and logic buffers.

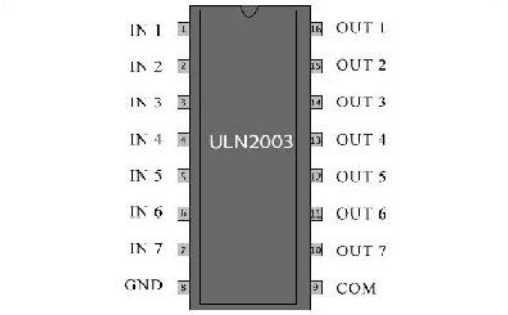


Fig.11 Pin Configuration

V. SOFTWARE DESCRIPTION

EMBEDDED C

Embedded C is most popular programming language in software field for developing electronic gadgets. Each processor used in electronic system is associated with embedded software. Embedded C programming plays a key role in performing specific function by the processor. All these devices are working based on microcontroller that are programmed by embedded C.

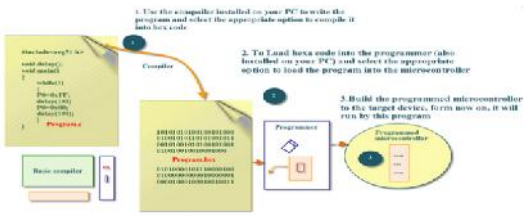


Fig.12 Embedded C format

In embedded system programming C code is preferred over other language. Due to the following reasons:

- Easy to understand
- High Reliability
- Portability
- Scalability

ARDUINO SOFTWARE IDE

The Arduino Integrated Development Environment or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuine hardware to upload programs and communicate with them. Since version 1.0.1, the Arduino Software (IDE) has been translated into 30+ different languages.

PYTHON IDLE

Python is a widely used high-level programming language for general-purpose programming, created by Guido van Rossum and first released in 1991. An interpreted language, Python has a design philosophy that emphasizes code readability and a syntax that allows programmers to express concepts in fewer lines of code than might be used in languages such as C++ or Java. The language provides constructs intended to enable writing clear programs on both a small and large scale.

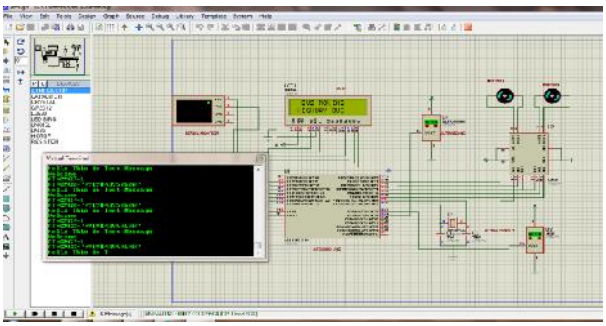
FACE_MASK_DETECTION

The bus face recognition payment system belongs to the “smart urban mobile payment system”. When the passenger gets into the car, he only needs to align his face with the smart face recognition terminal scanner, and the payment can be paid after the identification is passed. The whole process takes only 0.5 seconds. This is where the system compares the given individual to all the other individuals in the database and gives a ranked list of matches.

Fig.12 Face recognition

SIMULATION RESULTS:

LONG DISTANCE OBSTACLE DETECTION



SHORT DISTANCE OBJECT DETECTION

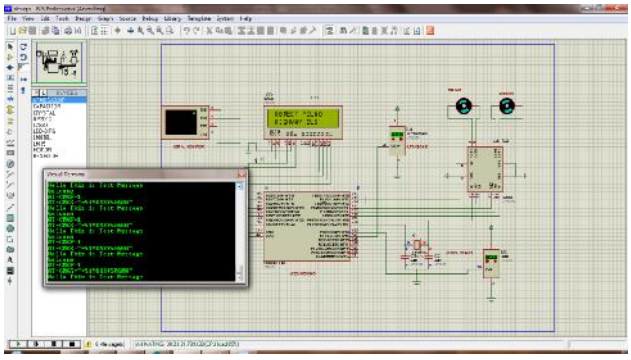


Fig.13 Simulation Output of MATLAP

LOCATION IDENTIFICATION

The GPS (Global Positioning System) bus tracking system combines the use of automatic vehicle location in individual vehicle with software that collects these fleet data for a comprehensive picture vehicle location. Bus information can be viewed on electronic maps via the internet or specialized software. Modern bus tracking systems commonly use GPS technology for locating the bus. These systems are particularly using in large cities.

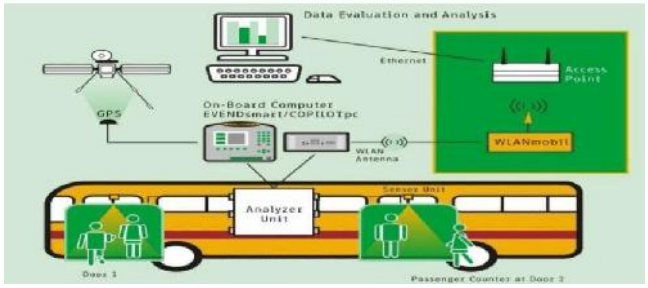


Fig.14 GPS Tracking

VI. VERIFICATION AND RESULTS

The hardware components and software are connected properly. After giving the power supply, the IR sensor can measure the detects motion, the ultrasonic sensor detects the maintain distance and the temperature sensor used to measure the body temperature and face using image processing and the output is given.

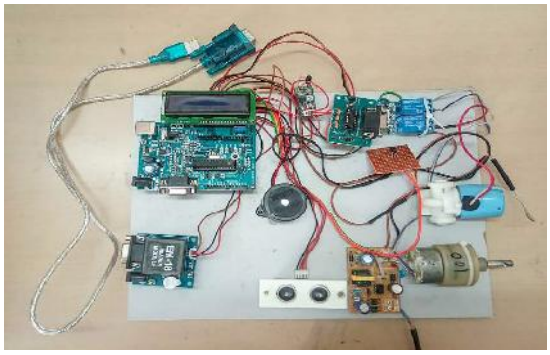


Fig. 15 Autonomous bus prototype

VII. CONCLUSION

This system is specially designed for maintaining the social distance in public buses during this pandemic situation. This also focus on reducing the possibilities of disease spreading by crowd and not sanitizing the hand while entering the bus. Once the sanitizing process and temperature checking process get over entering in to bus. The Smart safety system recognizes the passenger face mask and measures the temperature and provide necessary safety measures to the passenger. The distance measurement by using ultrasonic and ultra bright sensors were simulated by using Arduino IDE and proteus software GSM/GPS communication is achieved by using UART serial communication protocol.

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