Technology Integration for Deployment of Unmanned Vehicle for Public Transportation

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Abstract: Automation systems play a vital role in various fields such as industry, defence, medical applications etc. The emerging trends in engineering lead to advancement in different sectors. Recent trends on deployment of un-manned Ariel vehicles are being developed which can be used for multiple operations. With the concept of un-manned Ariel vehicles, this project is proposed for development of un-manned vehicles for public transit. This automated vehicle, on implementation can be an alternate source that can manage and control pollution and fuel consumption. This automated un-manned vehicle can be tracked to identify its position. Thus, this automated vehicle can be monitored which also gives the occupancy rate of the vehicle. As an added advantage, users can identify the position and the occupancy rate in any vehicle designed. Safety and security to the public users is assured with the usage of this technology. This transportation system can be achieved with integration of multiple technologies like GSM, wireless communication and robotics.

Keywords: Wireless communication, Occupancy-rate, Un-manned vehicle, Robotics, Global System for Mobile (GSM)

I. INTRODUCTION

Automation systems in India play a vital role in development of our nation. The usage of internet and emerging technologies are one of the key factors in it. This project is mainly focused on delivering these technologies to each individual and makes them use of it in the field of transport. Smart transportation technologies will meet the criteria to reach its destinations on time. Deployment of such vehicles will be useful to reduce air pollution, to reduce traffic even at peak hours, to avoid accidents at any cause and parking. By deployment of such vehicles, there will be high accuracy in bus transports. It is mainly focused on Effective minimization of delay in public transportation by reaching the destinations on time. It also reduces the usage of fuels which can be replaced with electricity and automation.

II. RELATED WORK

A. Vehicle Automation

This automated vehicle system is used to avoid accidents and it will be useful to reduce or to overcome faults that occur due to human errors. In short, the developed vehicle should be used in public transit with the guarantee that no lives will get affected by this system implementation. Time management has been focused in this project. This automated vehicle is designed to reach the stops at the time scheduled such that high accuracy is achieved. As an added advantage the number of passengers inside the vehicle can be identified easily. This is referred to as occupancy rate of the vehicle. This will be useful for passengers to plan prior to the arrival of vehicle at stops.

B. Wireless Data Transmission

The data obtained about the arrival of vehicle at each node or stops can be monitored by means of wireless data transfer. This is highly useful to track the location of the vehicle at any point. This tracking can be done by using GSM technology. Additionally, this wireless data transfer of vehicle position can be used by the passengers to get the information about the location of the vehicle. The end users can also retrieve the information regarding the occupancy rate of the vehicle. The number of passengers at the stop can be identified and it can be used for future reference. This system, in turn can be used for the safety concern of the public. Transportation with high end safety and security is aimed to achieve with this project. Hence it will be used to avoid any mistress that occurs due to security breach. This automation vehicle system can also be used along with renewable energy resources such as utilizing solar energy by placing solar panels at roof top of vehicles.

III. EXISTING WORK

A. Public Road Transport

Public transport system is the dominant mode of transport system in our day-to-day life. This is mostly by means of roadways. Since commutator railways are initially only in seven metropolitan cities that possess dedicated bus services to handle population of nearly twenty-five million. Tempos, cycle-rickshaws act as temporary transport services that can operate in areas where frequency of public transport is comparatively low. They are highly seen in medium sized cities. In India, cars occupy around eighty percent of vehicle population.

In general traffic in most of the cities in India moves slowly, where traffic jams and accidents are very common, but in some cities like wide roads and less vehicles contribute to lesser traffic. India has very poor records on road safely— greater number of people dies from road accidents every year. An Average of 13 people die every hour in road accidents in the country, also in the year 2007 road accidents claimed more than 130,000 lives, overtaking China. A study of traffic congestion in Asian cities ranked several Indian cities within the Top Ten for worst traffic.

B. BUS

Mostly in Indian cities buses take up over a maximum of public transport and act as a cheap and efficient mode of transport for all class of society. It is repeatedly maintained by Transport Corporation. Based on upcoming technologies, different facilities like low-floor buses for disabled passengers and air-conditioned buses for private car owners to manage damaged roads. Different facility enabled buses had been launched to give effective transport to the public. This played an important role in road transport. Some important notables like city Mumbai introduced air conditioned buses in 1998. Bangalore was the first city in India to introduce buses like Volvo B7RLE intra-city buses in India in January 2005. Bengaluru is the first Indian city to have an air-conditioned bus and stop, located near Cubban Park. The city of Chennai houses one of Asia's largest bus terminals, the Chennai Mofussil Bus Terminus.

IV. PROPOSED METHOD

A. Proposed Design

To deploy Unmanned vehicle which is an automated vehicle in public road transport area to achieve on-time arrival on stops. It also focuses on achieving air pollution reduction, vehicle traffic management, effective fuel management and Go-Green vehicle.

B. Proposed Solution

Fig. 1 is based on the automated vehicle line follower robotic technology. This plays a vital role of reaching the destination in desired route and reaching the necessary stops on-time. Secondly, the

process of reaching the stops on-time is focused by usage of calculating the speed required to reach its destiny. The user can know the location of this vehicle by its tracking information obtained from the GPS locator.

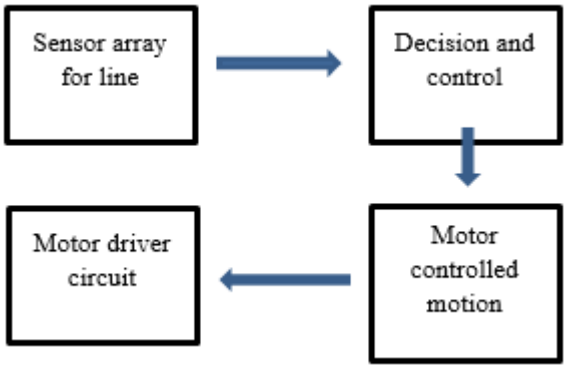

Fig. 1. Block diagram of line follower

As an added value to users, they can also know the occupancy rate of the bus and its location. The total seating capacity of the bus and the seats occupied can be known. The user can know these information's by using their smart phones or the display board available at the stops. The occupancy rate can be known by implementing Bi-directional visitor counter at the entry point of the bus. With the help of this counter we can know the whether the person is moving inside the bus or moving out of the bus.

The user can know the position of the vehicle (bus) by using the GSM technology. When the sender requests by sending a message, he/she will receive the vehicle location at the time of request by the user.

C. Task to Achieve

The vehicle is designed to follow a pre-defined track which is pre-programmed by the operator. This automated vehicle will be stopped in necessary nodes where the is needed to stop. This will be useful for common passengers to reach at their required destinations. This automated vehicle will have an occupancy counter which will be useful to detect the total number of passengers inside the vehicle. The occupancy count rate is obtained by using IR sensor pair or PIR sensor.

The nodes crossed by the vehicle will be identified and thus the present location of the vehicle can be obtained. This method will be used to track and identify the location, current position of the vehicle. This location status can be known to the end user or passenger using GSM technology. When the end user sends request to the particular vehicle identity number, the current location status of particular vehicle can be known.

This can be developed with multiple technologies for future up-gradation. As future technology is emerging, this method can be developed with using virtual line follower which will be useful for future real-time implementation. This automated vehicle is also designed to avoid accidents at a maximum rate. It can also be upgraded to follow traffic signs and traffic road signals certainly with image processing.

V. ARCHITECTURE OF THE PROPOSED SYSTEM

The proposed system has 3 major modules, they are,

1. Bus Module
2. Central control unit (admin module)

3. Client side application (User module)

1. BUS MODULE

The vehicle is tracked by identifying the number of nodes it crosses. Here the term node defines the passenger stopping point. Installation of this method will be highly effective to overcome all the climatic conditions. At any time, the location details can be stored in the server. This detail can be accessed by the end user as well as the controller unit or the operator unit. In the user end, Based upon the request from the user such as vehicle identity number, the data such as location of the vehicle will be obtained. Server is the most intermediate between bus module and user module. This database consists of real time information about vehicle as it includes actual arrival time and departure time.

2. CENTRAL CONTROL UNIT

This act as an admin module for the controller end to control and monitor entire process. In all conditions, the vehicle will be monitored and relevant data will be obtained from the vehicle unit. This also ensures the safety of the passengers

3. USER END MODULE

The user side module is simply an interactive web based application which services the various function of the system to the remote user end. The user side module obtains input from the user end and performs operation accordingly.

It is user's task to select or choose required terminal point for the user.

4. PROCESSOR

To implement this method, Arduino Mega 2560 controller is used. It consists of 54 digital I/O pins, 16 Analog pins with a clock speed of 16 Mhz. The hardware section deals with the transmitter and the receiver modules. This denotes the transmitter module. The First block comprises the system that has to be monitored. Secondly it has the voltage sensors that senses the voltage values from the system under observation.

Thirdly with Arduino Mega 2560 that has 54 digital input/output pins pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 Universal Asynchronous Receiver Transmitter a 16 Mhz crystal oscillator, a Universal Serial Bus connection, a power jack and a reset button. This processor is capable to work and execute multiple tasks at same time.

VI. MODELLING AND RESULTS

The role of using line follower robot in public transportation system adding additional features of wireless communication and geo-positioning system is the special key. The simulation output obtained is shown in Fig. 2 as follows.

The simulation result and the expected result are compared and seems to be same. Thus, on the basis of results from simulation, hardware is developed as per the configuration set-up and connected accordingly. Initially these sensors are tested and then motor driver is configured such that DC motors will be operated as per our requirement.

In hardware four DC motors are used where two of the DC motors will be connected to each other. In short two of the DC motors are connected in parallel to each other. The hardware images are shown in Fig. 2 and Fig. 3 as follows.

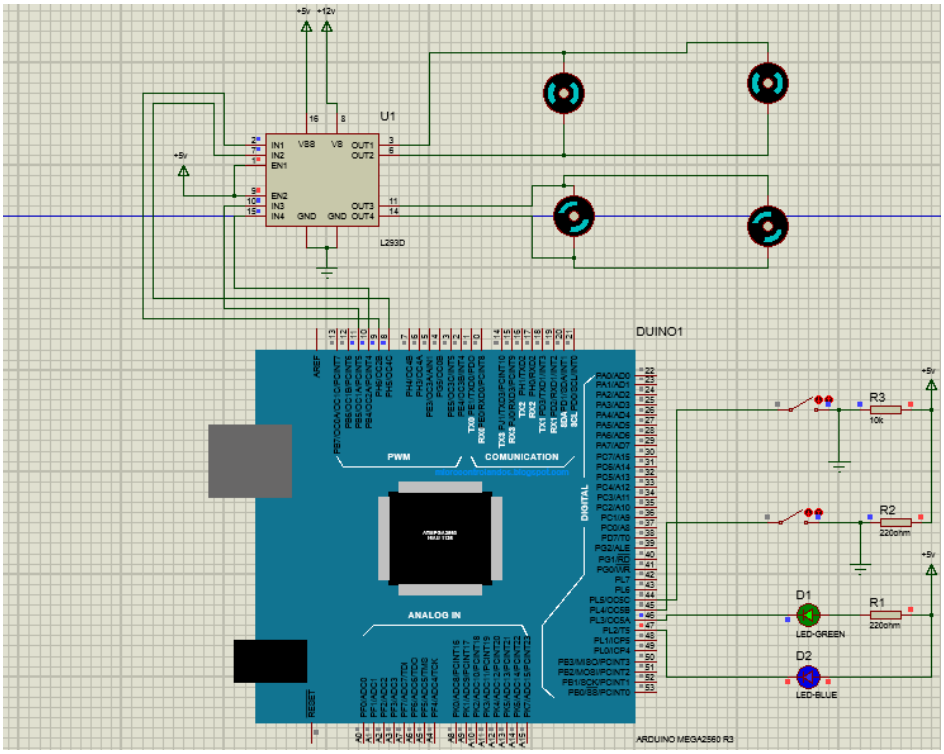

Fig. 2 Simulation Result

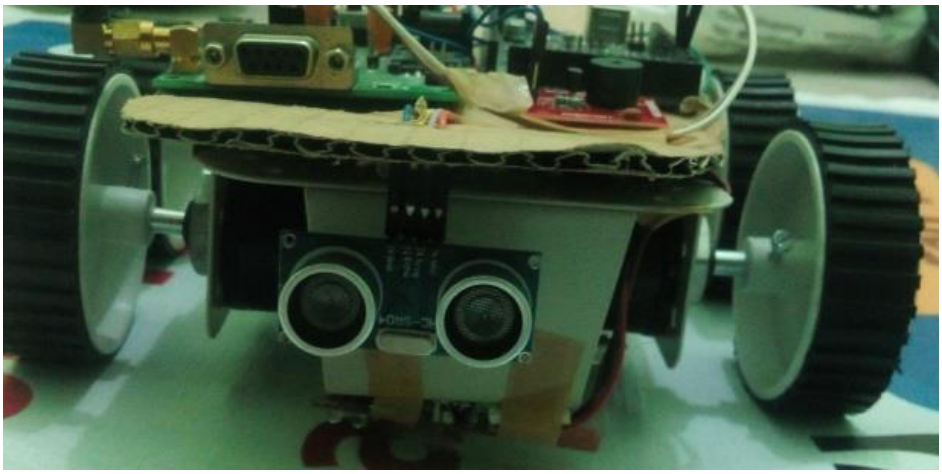

Fig. 3 Hardware model

In Fig.2 it shows the hardware model developed to perform the tasks assumed. The front view shows the ultrasonic sensor and IR sensor attached to the hardware module. This hardware model is developed as a demo model to test the logical operations and check the feasibility.

In Fig. 3 the top-view hardware model that contains the other required modules to perform the operation. It shows the Arduino mega board, GSM module and other required components and it's connections as well.

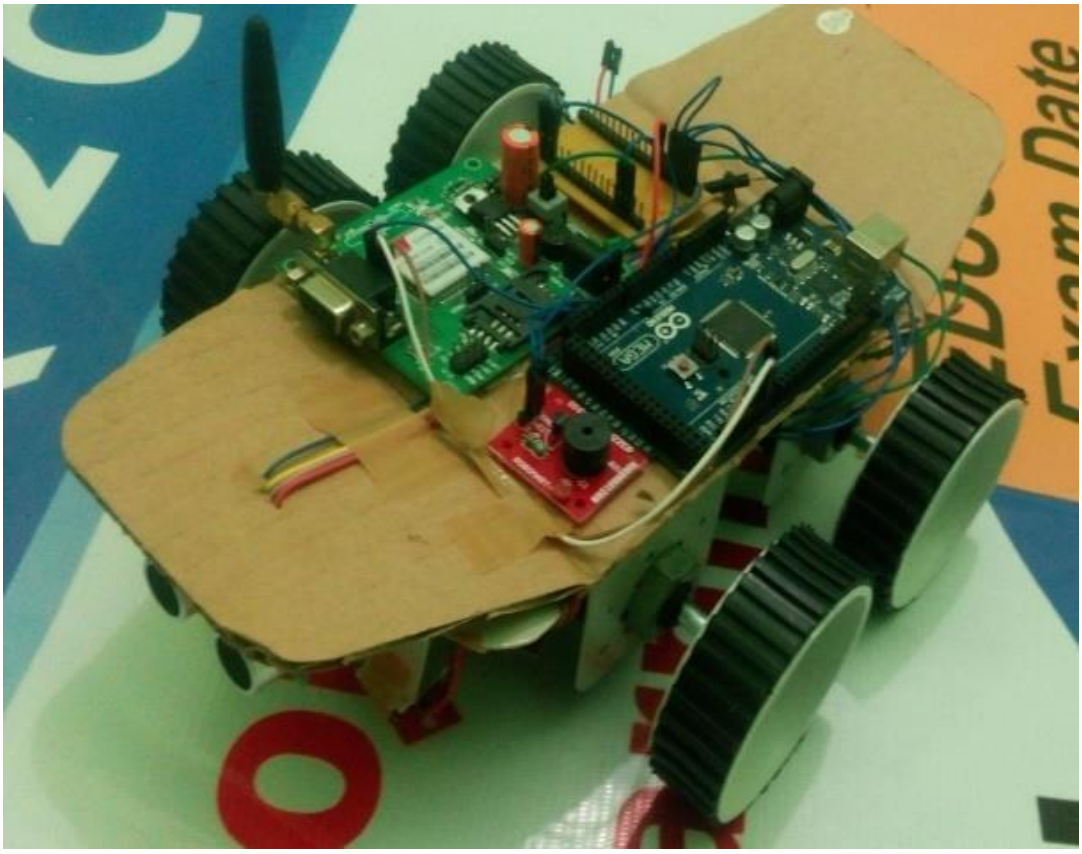

Fig. 4 Hardware model

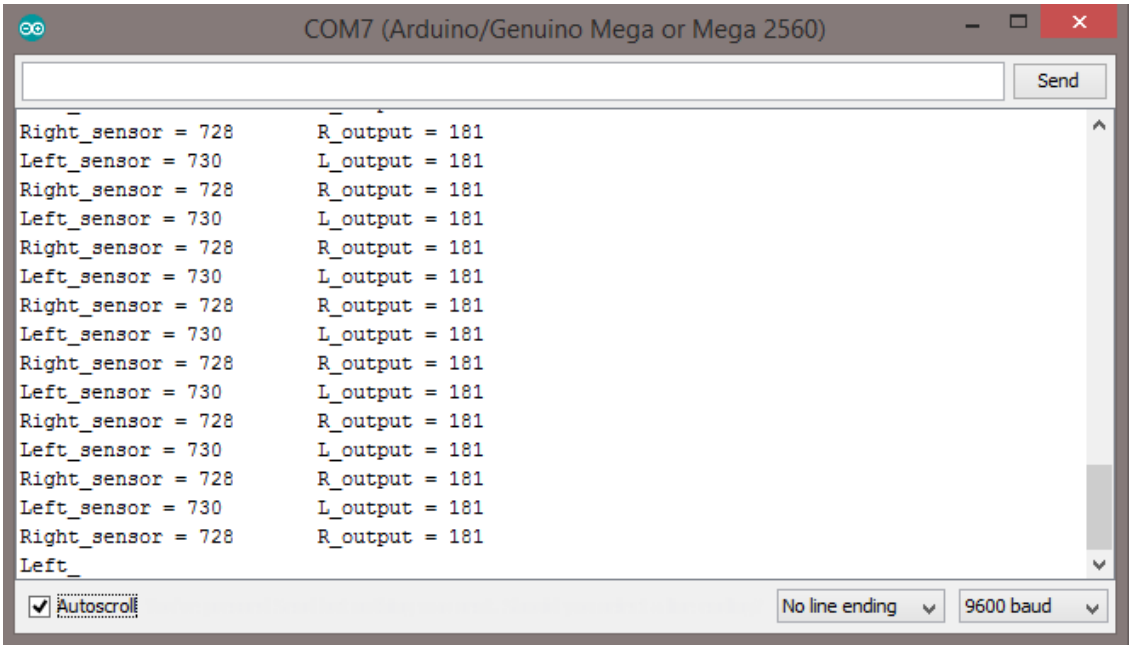

Fig. 5 IR-Sensor Output

In Fig. 5 the IR-sensor readings are mapped by enabling analogy to digital converter in the Arduino Mega controller. With these digital readings, we can monitor the changes in the IR sensor accurately. This IR sensor is is used to track the path designed by the user. Based on the reflection intensity, the values of the IR sensor vary. When the values go less than the range designed, the vehicle is

programmed to stop. Hence, based on the variation of the sensor values the speed and direction of the vehicle can be controlled and programmed.

This IR sensor values will be triggered to control the DC motor connected to the vehicle model. When the stopping node is identified, the vehicle will be stopped for few minutes. Later this vehicle will be back to movement process.

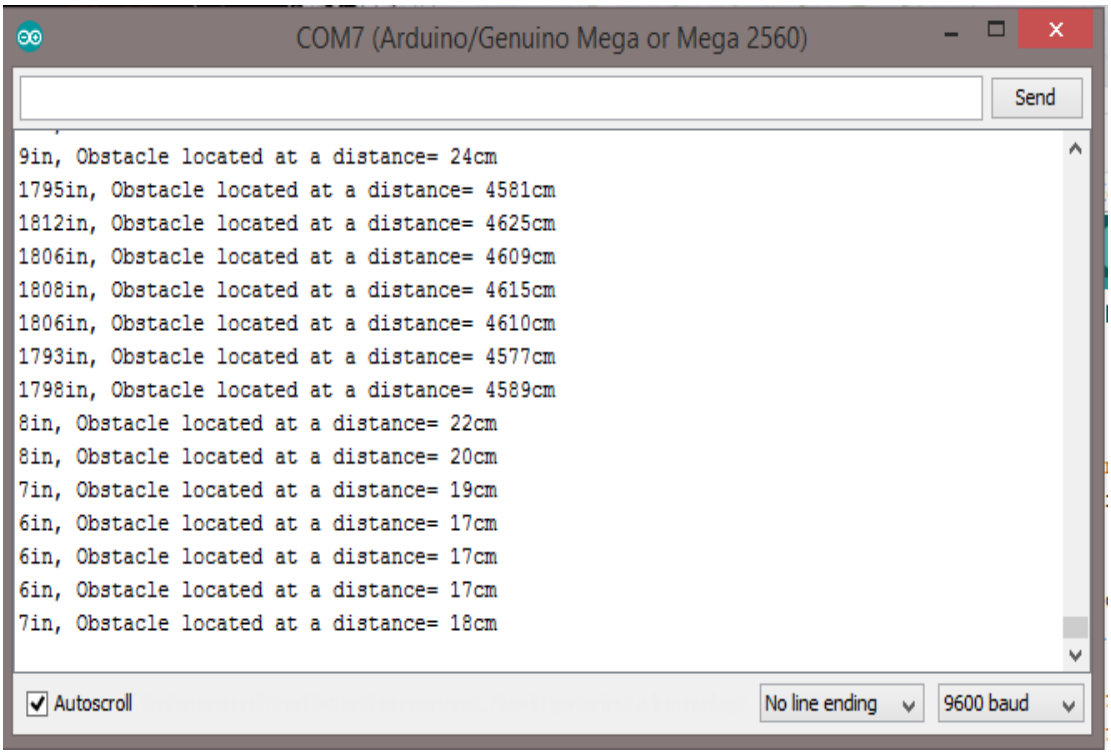

Fig. 6 Ultrasonic Sensor Output

In Fig. 6 the Ultrasonic sensor output reading is given. It is designed in a way such that if the object is located within a specified distance an alarm will be triggered and speed of the vehicle will be reduced and finally vehicle will be stopped. Thus, the outputs obtained is given in Fig.6.

A. IMPACT OF IMPLEMENTATION

This project if implemented will have a major impact in public. In day-to-day life, people rush in order to save time and stick to time. Hike in price of petrol and diesel seems a major problem in our country. This can be an alternative for those issues. This automated vehicle is smart enough to sense current situations and the data is regularly monitored from a control room. In case of emergency, it can be switched to manual operation mode and can be controlled from control unit also.

B. FEASIBLITY

This project can be feasible to implement in day-to-day life but it's limited to a point that, the roads should be laid properly. This is possible to implement in urban areas than rural areas. Implementation of this project will be an effective step towards the development of our country in the field of transportation for the future world.

VII. CONCLUSION

This project if implemented will have a major impact in public. In day-today life, people rush in order to save time and stick to time. Hike in price of petrol and diesel seems a major problem in our country. This can be an alternative for those issues. This automated vehicle is smart enough to sense current

situations and the data is regularly monitored from a control room. In case of emergency, it can be switched to manual operation mode and can be controlled from control unit also. The Li-Fi technology can be used and integrated to it. Internet-of-things and automotive electronics combine to develop a new unmanned vehicle that is capable to carry individuals. The design and development of this automotive smart vehicular robot can be highly used in field of medical for patients. This project will meet multiple applications and it will be suitable to meet future needs.

Conflict of interest: The authors declare that they have no conflict of interest.

Ethical statement: The authors declare that they have followed ethical responsibilities.

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