

# Raspberry Pi Based Fully Automated Rural Bus

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## ABSTRACT

This paper discusses about Fully automated rural bus based on raspberry pi. Raspberry pi is programmed by using python programming. The design and development of automated rural bus to prevent accident and to provide safety to the passenger as well as to the surrounding. Bus route is done by line follower using IR sensor. Door opening and closing is done by stepper motor. Number of passenger inside the bus was counted by IR sensor and obstacles are also avoided by means of IR sensor.

**KEYWORDS:** Automated bus, IR sensor, line follower.

## I. INTRODUCTION

Generally automated vehicles design and implementation involves plenty of works in order to create the artificial intelligence. This is because when it comes to an autonomous vehicle. There will be various parameters to be controlled such as vehicle movement, passenger management, door control, stopping period and so on. But in case of implementing it in a prototype manner approach, the ideology can be get implemented under a basic function call programming manner. In that case python operated raspberry pi is get used [3]. Were in that case a classic line follower robot moment control which can be get implemented to the bus. Were the bus being get propagated under a black road i.e, black line follower technique can be applied for its application. As raspberry pi is internet accessible controller and compatible with GSM and GPS mode of device components. Later model of automated vehicles consists of applications such as school bus position monitoring which is not much necessary in a rural operated bus [5]. The door controlling system is lately used in raspberry pi based home security system, which involves some security parameters to be got passed in order to get

the door to be opened. Were in our case it gets open and close automatically at a desired rate of time on reaching the bus stop [11]. Even some later projects involve the same application in a different manner of raspberry pi based automated toll system for which the toll gate gets automatically opened after the tolling procedures get completed [2]. Vehicle collision system previously used involves techniques such as image processing [1] and ultrasonic type proximity detection technique [8]. Were in case of a prototype model of the ideology involved, it doesn't need such tedious techniques were a classic IR type of obstacle detection technique can be get implemented. In case of vehicle motion operation previously done technique involves greater level of calibration and architecture design in order to achieve a low cost fully automated ground vehicle [9]. the technique of monitoring system for detecting and securing an object done by tohari ahamed has been slightly modified to a simpler passenger counter application by means of the IR sensor arrangement.

## II. RASPBERRY PI

Lohit Ujjainiya and M. Kalyan Chakravarthi (2015) proposed a vehicle collision avoidance system. They have used Raspberry Pi Camera module is employed for object detection and image acquisition. An investigation is performed on a test image in order to validate the best algorithm suitable for edge detection of images. They use image processing technique The whole system is implemented using Raspberry Pi board. A USB camera is used to detect and capture images. These images are saved in system memory and basic edge detection operations are performed on the test images captured by the camera. Open CV serves as the interface on which edge detection algorithms are allowed to run and perform basic image processing functions. The Open CV provides several inbuilt libraries for image processing [1].

S.Raju, K.Sanjay, T.Sathish Kumar, B.Madhini. They proposed a semi-autonomous vehicle to prevent accident. The proposed system is implemented with the help of ultrasonic sensor, camera module and raspberry pi. It is worked based on when the system detects that the vehicle is headed for a collision or is too close to an obstacle for safety. When hazard is detected, the system will take control of the vehicle, alters the movement and then hand over the control back to driver. We monitor the distance between the obstacle and the vehicle to identify occurrence of abnormality, it also allows the driver to follow traffic rules like if the signal glows red the vehicle has to stop, the cameras placed in the vehicle senses the signal color and alters the vehicle mobility [8].

Prashant A. Shinde and Y.B.Mane (2015). they proposed advance vehicle monitoring and tracking system. It is designed for monitoring the school vehicle from any location A to location B at real time and provide safety environment to the traveler. The proposed system would make good use of new technology that based on Embedded Linux board namely Raspberry Pi and its advanced feature of storing database at real time. The proposed system works on Global Positioning System (GPS) and Global System for Mobile Communication (GSM) which is used for vehicle tracking and monitoring mechanism. The GPS gives current location of the vehicle; GPRS sends the tracking information to the server and the GSM is used for sending alert message to vehicle's owner mobile. The proposed system would place inside the vehicle whose position is to be determined on the web page and monitored at real time [5].

Nikhil Ollukaren, Dr. Kevin McFall (2014). they proposed a low cost platform for autonomous ground vehicle research. They design an affordable autonomous ground vehicle platform from the ground up. Using an independent direct drive rear wheel system, the vehicle can achieve a fixed axis rotation. Using vision algorithms loaded onto a Raspberry Pi the robot is able to detect a red target and send commands to the Arduino. The Arduino controls the motion logic and allows the vehicle to follow the target. The vehicle can also be driven manually using a hand held controller. Using simple and affordable microcontroller boards, a vehicle was created that was able to track and follow a specified moving target using visual algorithms to supply motion logic. It uses image processing algorithms

to offer obstacle avoidance and detection of road boundaries for steering control [9].

Tohari Ahmad, Hudan Studiawan and Tirta Taru- na Ramadhan (2014). They proposed a monitoring system for detecting and securing an object. It is developed based on raspberry pi. A monitoring system is constructed by a camera along with all related devices for transferring the data. This can be either wireless or wired devices, depending on the nature and requirements of the system. Monitoring certain areas or territories is needed in order to maintain the security. This often requires the security officers to manually monitor them. They propose a relatively cheap monitoring system which has capability of detecting an object (human), calculating its distance, determining its coordinate and taking its picture. These data are then sent to the user through email. This real time system has made it easier for the user to make a further decision. it is appropriate to use, even though in the condition when the light is low [5].

Mohammad Kawser Jahan Raihan, Mohammad Saifur Rahaman, Mohammad Kaium Sarkar and Sekh Mahfuz(2013). They proposed an automated toll system using image processing technique based on raspberry pi. This minicomputer has the ability of image processing and control a complete toll system. A camera will be used to take picture of the vehicle's name plate to sort the toll charge according to vehicles category. Along with multiple automatic tolls taking booth there will be a manual booth with operator also who will handle those vehicles which experience issues with any of the automatic toll taking booth. There are two types of unit in this system. One is automated toll unit and another is manually toll collecting unit. Both these units are connected internally through RF transceiver. If automated unit face any obstacles like unauthorized vehicle number, insufficient balance etc. then the vehicle needs to pay toll through manual system [2].

### III. PROPOSED SYSTEM DESIGN

The primary stage of the project starts from the chassis design and components

portioning. Thus it involves deciding of components getting used purpose and positioning of the components. Total power needed for the whole system and power supply portioning (fig.1). Thus main features such as the door system, motor and wheel arrangement, proximity sensor placement, line follower positioning and passenger counting system arrangement.

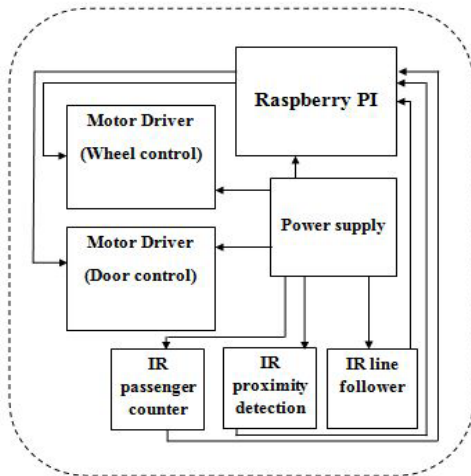


Fig. 1 Block Diagram Of Automated Bus

**a. DC motor control**

The wheel moments, turning, braking and other moment oriented actions are being get performed by means of the motor driver operation. There by DC motor which get operated by means of a constant DC voltage with forward and backward control been performed by means of the change in polarity. In case of the drive mode of controlling action being done, lets us to change polarity, PWM and on/off control by means of the GPIO signals. In that case the motor control board been used is the L290 type driver IC, Which is capable of controlling the entire motor actions by means controller output signals, proper wheel alignment and motor positioning enables smooth way of vehicle movement and proper turnings(fig. 2). Thus primarily a test dc motor is being get tested with the output of the controller with respect to the python program been run. after successful testing of the single dc motor the same is been get implemented for all four motors and there by

respected modifications in the program are been done.

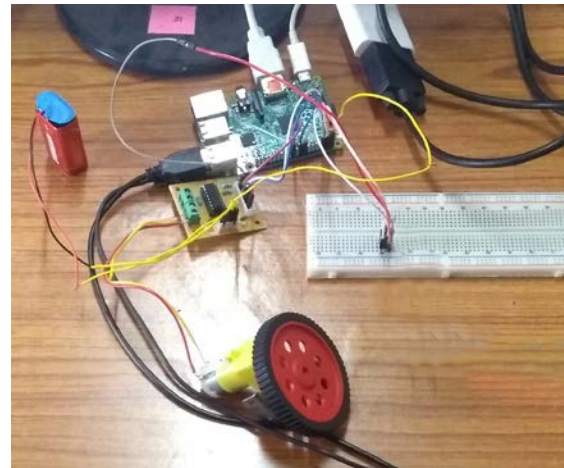


Fig. 2 DC Motor Interface with Raspberry Pi

**b. IR sensor control and testing**

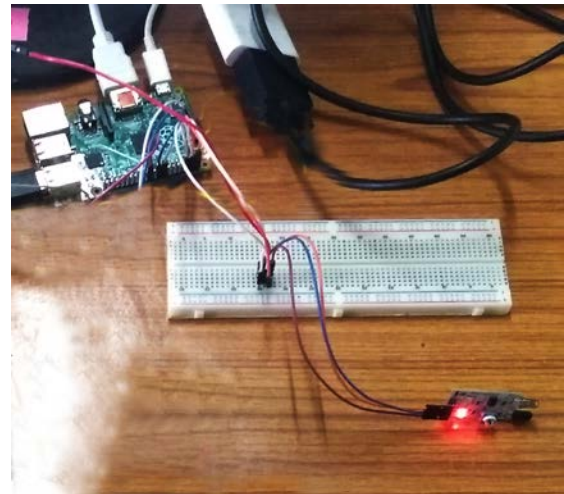
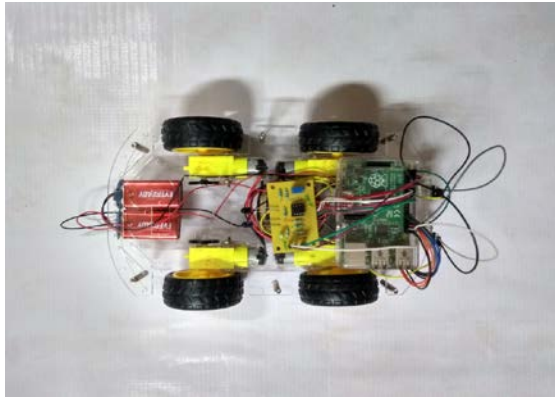


Fig. 3 IR Sensor Interface with Raspberry Pi

IR sensor is a type of optical sensor which consists of an IR transmitter and an IR receiver, was the IR receiver receiving the signal emitted by the IR transmitter rapidly with respect to the object been present nears the IR sensor. i.e, the closer the object or human or animal present the faster the IR get reflected and the sensor signal get enabled. (fig. 3) In our case the IR proximity detection is been done in order to sense the obstacle been present at the effective region of the vehicle. Over three or more of these are get placed around the vehicles architecture. Thus as usual one of the IR sensor is been separately

tested with respect to the python input assumption programming.

#### IV. Hardware Implementation



**Fig. 4 Fully Automated Bus**

The demo version of the setup includes chassis fitted with the motors with wheels. And with the IR proximity has been get placed with respect to the effective region of vehicle collision. The working of the test1 structure includes operation such as continuous running of the vehicle with in the specified or desired route with proper and safe turning. Also autonomous obstacle avoidance with a limited timed loop checking of the obstacle to be get passed. Also the model includes a beta version of bus stop waiting action functioning. The test result has some errors including improper speed during turning path, which causes the vehicle to be displaced from the path. Thus there will be a chance of the vehicle to be change from its actual route. But the line following and obstacle avoidance action works perfectly.

##### a. Autonomous door system

The autonomous door consists of functions such gets opened when the vehicle reaches the bus stop and simultaneous waiting of desired time period with resultant door closing after desired time. The door is constructed with a basic rack and pinion arrangement with geared motor control approach.

##### b. Passenger counting system

The passenger counting application plays major role in the whole system controlling the

amount passengers has been aboard in the vehicle. Thus proper increment and decrement of the passenger count must be taken under control. In that case an IR sensor based counter setup arrangement is been get implemented nearer to the door mechanism.

#### V. Result

So far results that are been taken are collision avoidance has been successfully implemented. Proper propagation with in the desired route by means line follower. Number of passenger counted and limited. In case of vehicle to be get operated in the rural area faces a problem due to the roads color. The infrared radiation only gets reflected under and brighter surface such as white platform. There by in case of the black platform the IR radiation gets absorbed and the receiver does not get any signals. Hence the programming logic must be get updated in the manner to follow black path and avoid white path. Thus the pattern of the vehicle propagation must be done by means of the white line.

#### VI. Conclusion

A Raspberry pi based fully automated rural bus has been proposed. Major features of fully automated rural bus as follows. Obstacles are avoided by using IR sensor. Bus route is feed by using line follower. If automated bus is used for public transport, it reduces the accidents due to human mistakes. Number of passenger inside the bus is counted by IR sensor. Automated bus is more useful to reduce accidents happen in the road.

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