Automated Raspberry Pi Based Rural Bus with IoT Interfacing

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Abstract

The paper discusses about the techniques involved in controlling n bus interface with IOT. Due to the interfacing of IOT, all the control parameters get involved such as fuel level, location, amount of passengers, tickets collected, time of reaching destination, door state, lamp control, parts condition etc., can be both monitored and controlled in some case. The vision of the project is to control the rural transportation bus without any intervention of human in the bus, rather monitoring it in a different location. In case of controlling codes were developed under the logic of python platform based programming.
Keywords- Automated Bus, IoT, Raspberry Pi

I. INTRODUCTION

The project involves a prototype model representing the major means of control parameters been involved. The major means includes bus turning, bus movement, door control, lamp intensity with respect to time, time of reaching the stop, vehicle and obstacle avoidance, passenger counting, speed monitoring etc. The main region of focus involves interfacing the project parameters and outputs with IOT control interface. This includes monitoring of parameters such as bus stop feeding, number of passengers present inside the vehicle and door condition. These monitoring allows the user to make sure that none of the parameters exceeds their limit or initial state. So that minor issues may not occur. Generally, IOT interfaced bus runs under a remote operated control and will thus involves a partial involvement of human. But in our case all the parameters involved in controlling a rural bus is get controlled and monitored. This is done in order to mainly avoid human errors get involved generally in a rural vehicle. Though it is fully operated under automation field it involves more precise calibration, control action and monitoring. When this application is get interfaced in an IOT platform it will be an enormous advantage in the field of transport. The major involvement will be of using the Raspberry Pi. Generally, the programming involved in Raspberry Pi will get run on python platform. This project consists of its main programming been get held at a framework known as webiopi. The advantage of interfacing the project with IOT enable multi-tasking, communication and interaction with such vehicles, assurance of avoiding errors and one common control bench can be get done.

II. LITERATURE REVIEW

Mohannad Ibrahim, abdelghaforelgamri, shariefbabiker and Ahmed Mohamed (2015) proposed an Internet of Things based Smart Environmental Monitoring using the Raspberry-Pi Computer. They proposed an approach to build a cost-effective standardized environmental monitoring device using the Raspberry-Pi. The system was designed using Python Programming language and can be controlled and accessed remotely through an Internet of Things platform. It takes information about the surrounding environment through sensors and uploads it directly to the internet, where it can be accessed anytime and anywhere through internet. Experimental results demonstrated that the system is able to accurately measure the temperature, humidity, light level and

concentrations of the carbon monoxide harmful air pollutant. It's also designed to detect earthquakes through an assembled seismic sensor.

Aamirnizam Ansari, Mohamed Sedkyl, Neelam Sharma and Anurag Tyagil (2015) proposed an Internet of Things Approach for Motion Detection using Raspberry Pi. They describe a security alarm system using low processing power chips using Internet of things which helps to monitor and get alarms. When motion is detected and sends photos and videos to a cloud server. Moreover, internet of things based application can be used remotely to view the activity and get notifications when motion is detected. The photos and videos are sent directly to a cloud server, when the cloud is not available then the data is stored locally on the Raspberry Pi and sent when the connection resumes. Therefore, advantages like these make this application ideal for monitoring homes in absence.

Md.nasimuzzaman Chowdhury, Md.shibleenooman, srijonsarker (2013) proposed an access control of door and home security by raspberry pi through internet. They proposed a system is being developed to connect any door with the internet, so that the access control system can be controlled from anywhere in the world. In that case one is not at home and a visitor is at his door steps then the authorized person will be notified about the visitor via twitter and the person can see the visitor from the web through the camera from anywhere and the system will take a picture of the visitor and keep a record by sending an attachment through E-mail or tweet in twitter. If the authorized person wants to give a message, the visitor it can be sent easily through the internet and it will appear in a screen on the front face of the door. The door lock can be controlled through the internet. With the help of this system an evidence of the visitor can be kept as a record if any emergency case or situation occurs.

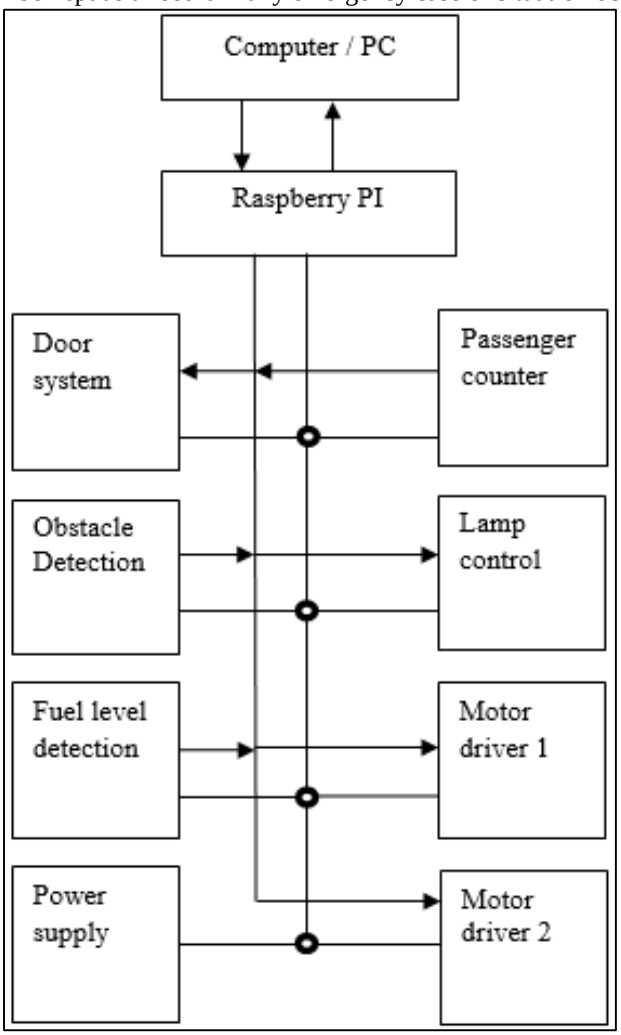

Fig. 1: Block Diagram

Mirjana Maksimović, Vladimir Vujović, Nikola Davidović, Vladimir Milošević and brankoperišić (2014) proposed a raspberry pi as internet of things hardware. The Raspberry Pi, fully customizable and programmable small computer board. Comparative analysis of its key elements and performances with some of current existing IOT prototype platforms have shown that despite few disadvantages, the Raspberry Pi remains an inexpensive computer with its very successfully usage in diverse range of research applications in IOT vision. The Internet of Things (IOT) ideology can be looked as a highly dynamic and radically distributed networked system composed of a very large number of identifiable smart objects. These objects are able to communicate and to interact among themselves, with end-users or other entities in the network.

Cheahwai Zhao, jayanandjegatheesan and Son Chee Loon (2015) proposed an exploring IOT application using raspberry pi. They explore the use of Raspberry Pi to function as a server in which several laptops are connected to it to copy, store and delete the file over network. It requires authentication for user login before granting access to the file to ensure data integrity and security. File server is widely used in many areas, for example in education for uploading study note into the serve and student immediate downloading it into their computer. Moreover, this work also explores the use of Raspberry Pi B+ model and xbee(zigbee module) to demonstrate wireless communication data transmission, proving the validity of usage as a mobile low-power wireless network communication. The main goal of the research is to explore the use of Raspberry Pi for client-server communication using various wireless communication scenarios such as Wi-Fi and zigbee. It brings advantage as it provides reliable and stable communication system for instruments and controls. However, the cost of cables necessary is very costly.

III. INTERFACING RASPBERRY PI WITH IOT

This is the major and complicated task involved in the project. But it's quite simple to interface raspberry pi with your server. It primarily needs a framework known as webiopi. Webiopi is a tool used by Pi to control, actuate and monitor sensor, relays, actuator by means of any application or from a web browser by means of accessing the GPIO pins present in the Pi. Thus it enables a web based interface to access the pi connecting raspberry pi into a web connected device. The advantage of using webiopi is that the overall function code doesn't need to be present in the python. Once the webiopi is get installed to the raspberry pi present.

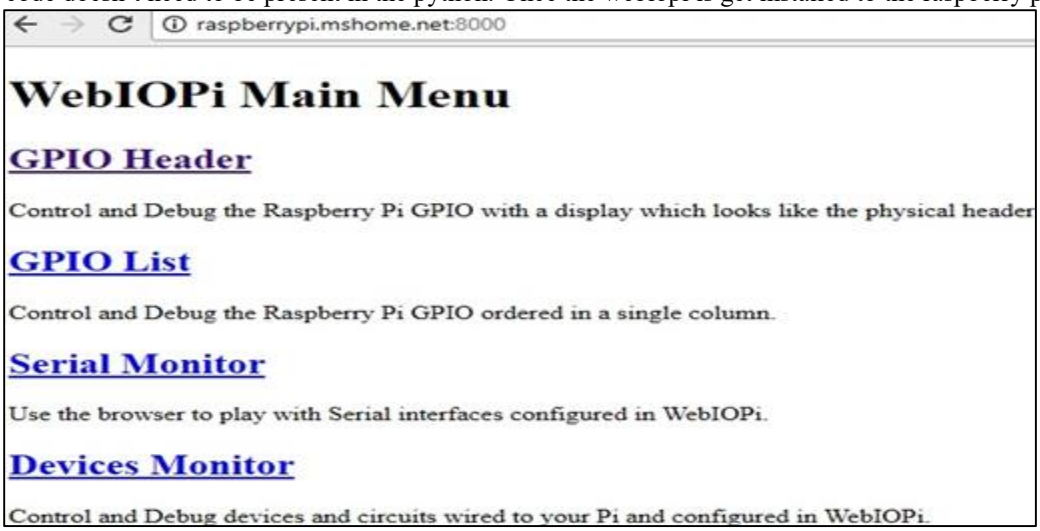

Fig. 2: WebIOPi menu page

It is get assigned with a specific IP address having a user name and password. Under which the html code and css are been accessed. Then it requires any FDP/SCP coping software in order to copy files to the raspberry pi from the PC. After that develop a JAVA script code in order to communicate with the webiopi with the help of CSS code we created our own webpage with controlling and monitoring panels. Later to link the java script with the CSS sheet a desirable html code is being developed and ran. The interfacing component can be either of an Ethernet cable or wireless dongle with respect to the need.

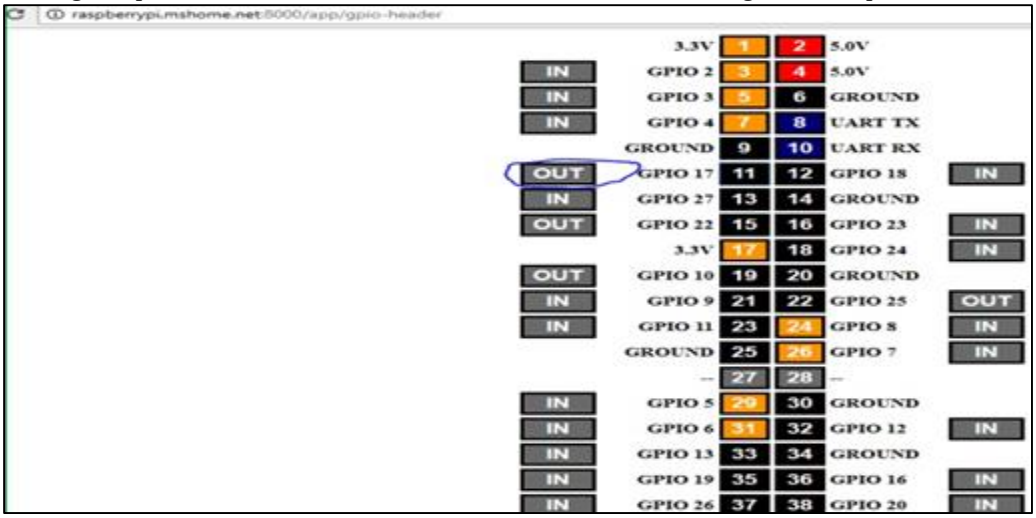

Fig. 3: WebIOPi GPIO access page

Fig. 4: CSS sheet

Fig. 5: Control prompt setting up

IV. VEHICLE MOVEMENT CONTROL

Vehicle movement includes moving of the vehicle to go forward, turn right, turn left and in some case it may move backward. The movement of the vehicle is getting achieved by means of the DC motors present in case of the prototype. The DC motors is being get actuated with help of the motor driver circuit. In our case it is an L932d motor driver circuit drives with a power supply up to 12v and output peak current of 2A. The motor driver can operate 2 motors at a time. The models we use consist of four motors for controlling four-wheel movement. It needs two of these motor drivers. The motor driver is get feed with the raspberry pi control signals from the desired configured GPIO pins present. These GPIO signals gives functional command to the driver to whether the motor should move forward or backward and also rate of speed is get controlled with the help of switching action of the motor present. The direction of turning can be getting controlled, for the vehicle to be moved across a specified route desired by the user.

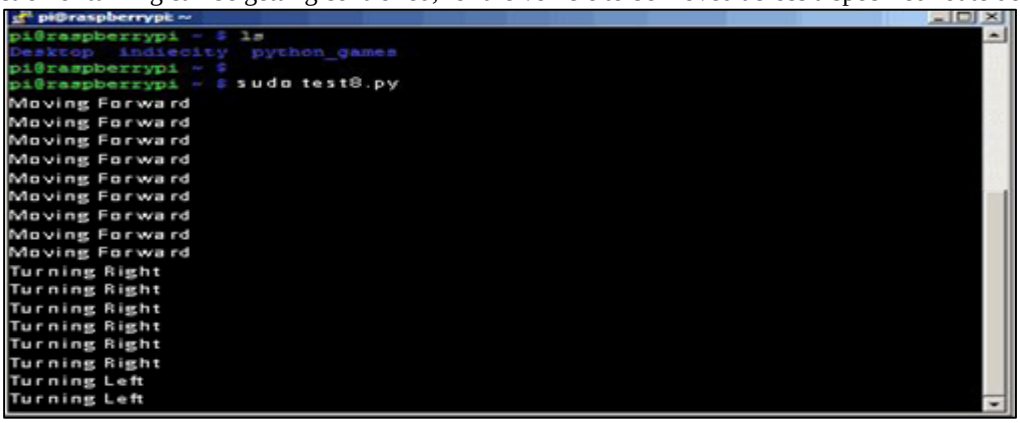

Fig. 6: Movement test outputs

A. Line Follower

Line follower system is get used in the vehicle were line following is a technic of following a specific or desired coloured line. There by a passive type of sensor with detection of the particular colour is get used as the primary sensing element. In our case an IR sensor is get used. The general characteristics of IR radiation will get reflected only under bright surface such as white etc., obviously not get reflected with black surface.

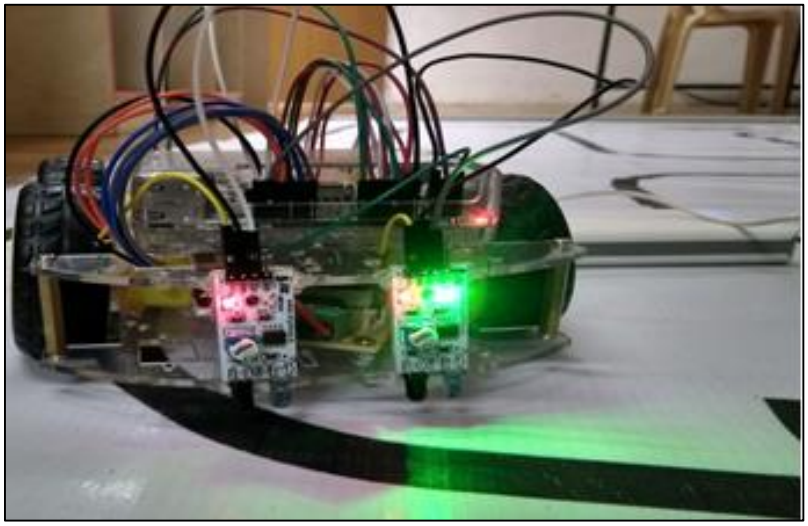

Fig. 7: Line follower setup

There by in case the vehicle gets propagated in the rural road follows the white marking over black road. And the corresponding stoppings is also get marked by means of the white lines. Due to this logical mechanism we can reduce the cost without using any wireless routeing or guidance system.

V. ANTI-COLLISION SYSTEM

The prior parameter to be got focused major is the avoidance of other vehicles while moving. In that case the vehicle needs to follow the line in order to maintain its lane. In case of other vehicles get passes into our lane. The bus need to avoid collision with that vehicle. For this purpose, the vehicles are used with an IR sensor as a sensing element in the major areas of vehicle get contact and the type used will have a detection range of one to two meters, when the vehicle gets into this range either rapidly or normal. The bus stops its way of motion and waits for the obstacle to be get cleared from its path. This process will get preceded continuously throughout the main process of the bus. This is done in order to be precautious of avoiding collision all the time. This also ensures any obstacle get present in the path of the vehicle even while turning in the corners. There by both means of collision occurrence either by the bus itself or by any other vehicles.

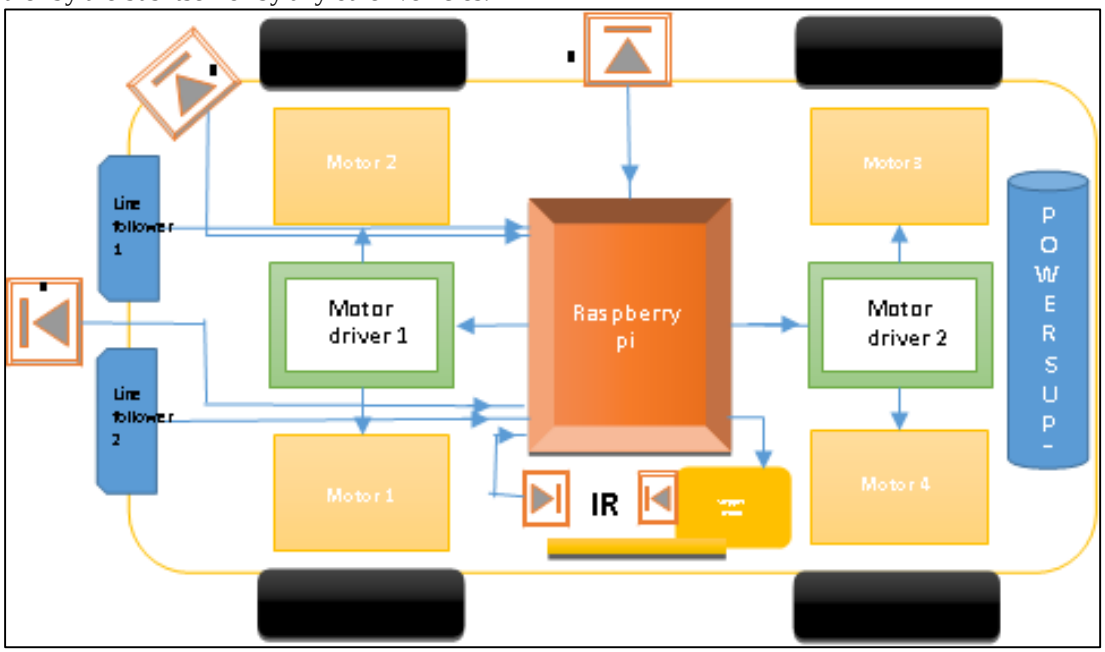

Fig. 8: Components placing's

VI. ACCIDENT PREVENTION SYSTEM

It is similar to the anti-collision system. This system specifically deals with detection of obstacles such as human crossing, animal interference, two wheeler crossing, bicycle interference and line pass into walkway. Sometimes in case of any human crossing into the lane of the bus mistakenly unnoticed the bus arrive may met up with an accident. This also applies with animals too. In such a case the bus uses an PIR sensor as the sensing element in order to detect obstacles like this case move precisely than other sensors. These PIR sensors thus get placed in the major area of focus were the interventions like these get occurs. This system also helps in case of any malfunction take place in other system that may cause the vehicle to be get diverted from the lane to the walk way. In that case this system avoids the vehicle from hurting the public due to these malfunctions.

VII. PASSENGER ORGANIZING SYSTEM

Passenger organizing includes combination of functions such as door opening, closing while reaching and leaving the stops. Passenger counting including increment and decrement of the passengers, waiting in the bus stop with a specific time. This is to control the crowd present inside the vehicle which is useful to avoid any foot boarding, passenger congestion. The passenger counting is done by means of an IR sensor. When the IR radiation get cut off each time the corresponding counting gets incremented. In order to achieve decrementing process another IR sensor can be added parallel and thus with respect to the first sensor get enabled the corresponding incrementing and decrementing operation. The door state changes with respect to the bus reaching the stoppings. The door is thus moved by a rack and pinion arrangement of tray interfaced with a motor shaft.

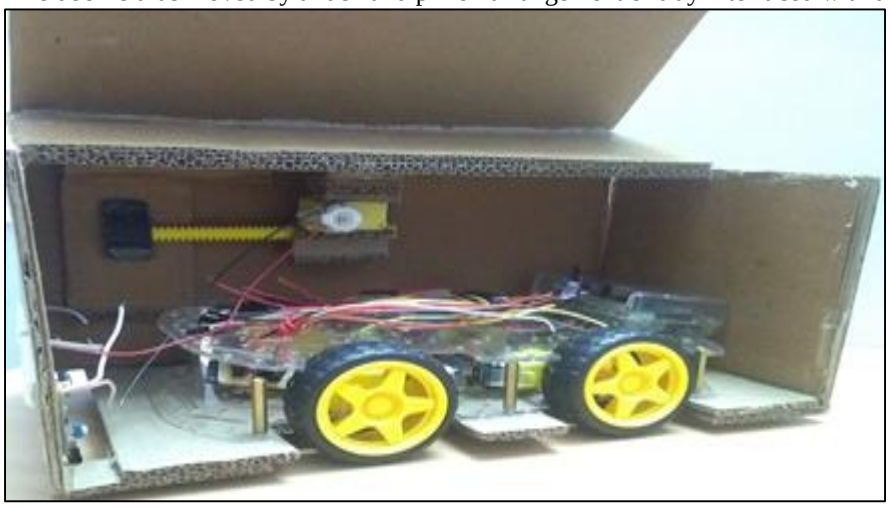

Fig. 9: Internal Skeleton

VIII. RESULT

The interfacing part of IOT with the Raspberry Pi has been implemented successfully. The drawback is that interfacing is getting done through an Ethernet cabling. That is the interfacing is a wired protocol. There by this interfacing still need to be get updated to wireless system with help of a dongle instead of using Ethernet cable. Other that parameter such as door control, accident and collision prevention system, and vehicle movement control and passenger's management get controlled and monitored successfully.

IX. CONCLUSION

The project thus works well under the major and main parameters to be got done. Other tasks pending still need to be getting improved and updated. The main update to be get implemented is that intercommunication between the vehicles. When such tasks and goals are getting achieved successfully, the project will be a good social application provider.

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