

Design and Implementation of Control Unit for Railways using Power Line Data Transmission

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Abstract— Our project is based on data transmission through power line. And this communication is implemented in railways by transmitting data through it. In this we are using power line communication module, which is defined as “carrying data on a conductor and also used for electric power transmission”. It act as both transceiver with secure and fast condition. The above concept is exiting concept, now a days which are used in home appliances. Now the proposed concept is implemented in railways, by sending a data from junction to engine driver or vice-versa. This process is done in a single line cable. The main advantage in it is data can be transmitted in fraction of seconds. In case of any emergency data can be transmitted and we can do the required process. Thus we discussed completely about the proposed concept in power line communication.

Keywords- *powerline; power line communication module; railways.*

I. INTRODUCTION

The concept of transferring the data signal through the single power line which is already used in the telegraph i.e., power distribution where the number of devices installed through wiring can exceeds far on the number of installed in AC mains. The reason for this is not, as one can think having the possible of AC main communication up to recent decade. In 1920's an American Telephone and Telegraph company had discussed in field of “Carrier Transmission over Power Lines”.

For the past years, power lines have been used for the transmission of electricity; but now a days with the Advance of modem networking technologies and the need for information sharing, data transmission over power lines has seen a really big growth. This technologies already used for sharing information such as telephone wiring, optical cable, Ethernet cabling, fiber optic and wireless have each its limitations in cost and reliability with complex. A wide range of power-line carrier communication technologies are needed for various applications, ranging from home automation to Internet access which is often called broadband over power lines (BPL)[5]. Different types of power-line communications use different frequency band rate and we are using an a 9600 band rate for Data Transmission. Since the power distribution system was originally intended for transmission of Existing AC power at typical frequencies of 50 or 60 Hz, In this project we are going to discuss the advantages of using power lines as a communication medium and the wide range of applications that this technology can provide, in addition to the

implementation in Railways using the data transmission over power lines.

II. POWER LINE COMMUNICATION

“Power line communication system can be defined as is a system for carrying data on a conductor also used for electric power transmission”. Power Line Communication (PLC) technology uses standard coaxial cables else power supply cables to allow the communication between different devices. Now a days this technology is widely used in home, building and industry automation, because it avoids the installation of additional network cables. Due to past low data rate communication needs, utility companies used PLC to maintain power grid New technologies allow high data-rate communication over low-tension lines.

III. EXISTING METHODS

A. *Power line Communication Based on Energy Meter Automation*

In the existing concept, it is based on the power line communication in multiplex data which can be used in various devices .This method of communication it has new application that we can prove this technology can control the energy meter automatically. The process of connection/Disconnection of consumers, power meter can control automatically which carries the information in the supply of consumers. Using this intelligent power meter, it can automatic connect and disconnect the power supply of customers.

Automating kilowatt-hour (kWh) meter reading has become a necessity for most energy suppliers for free customer choice[1]. The technology of automatically collecting consumption, diagnostic, and status data from energy metering devices and transferring that data to a central database for billing, and analyzing. This technology mainly saves utility providers the expense of periodic trips to each physical location to read a meter. Another advantage is that billing can be based on near real-time consumption rather than on estimates based on past or predicted consumption. This study shown that a human meter reader could only achieve an equivalent average information rate of about 1bit/s, which is very slow. [1]

1) *Automated EB Billing Procedure*

- The automated EB billing system eliminates the need to pay the bills at the EB office.
- This system allows the user to get updated details of the power used in his house.
- The user can also verify if the bill received is the right one or not.
- Finally the wireless method sending data is feasible even when more buildings are being built into the Network.

B. *Power line Communication in Home-Building Automation systems*

This system is also based on the power line communication, which is used to implement in the home automation application it is uses because the different application equipments to manage in home environment to manage in home environment with safe and comfortable way. This same concept is also possible to implement in bigger building named as building automations.

The home appliance is connected to the power line, it create noise, disturb and make some problems during power line data transmission. If a house is near an electric closet, the power line may be unstable. The intent of this work is to show the differences between PLCs for power distribution net and PLCs for home and building environments, to indicate the methods to send data over the power line, to explain which are the automations that is possible to connect and to control in a power line demotic system [4].

1) *Drawbacks*

- Transmit and receiving data rate is slow due to some noise in wireless transmission.
- They are using more topologies for controlling different applications.
- *High noise will occur when we use two or more equipments at same time.*

IV. PROPOSED METHOD

The main advantage in it is data can be transmitted in fraction of seconds. In case of any emergency data can be transmitted and we can do the required process. We have tried to Implement the new application ie., the control unit for railway using power line data transmission. Here, the Power Line Communication Modem act as a transceiver, which is used for transmitting and receiving data through power line (Vice-Versa).

The data security process is done by encoder and decoder ie., encryption and decryption done along the transceiver. This process is used in station to engine driver and vice-versa. We also implemented the Motor speed control for controlling the train speed. It seems that if any fire accident or track detection occur it automatically slow down the speed of train and immediately it will intimate to the train driver and to near station as well as main station. Then it also can intimate the basic commands. . In our project the transition data rate is high compared to the existing project. So this concept can also be implemented for many application because most of the areas are used Power lines.

V. BLOCK DIAGRAM FOR PROPOSED CONCEPT

The block diagram of our proposed concept of two section that are transmitter section and receiver section.

A. *Transmitter Section*

- Here the, Transmitter section is placed in the junction or station.
- This section is transmitted the serial data through power line to engine driver.
- These all are controlled by a personal computer (PC) using Terminal Software because it is an open source.
- It consist of encoder and decoder in the security block. It used to encrypt and decrypt the serial data for secure purpose.

B. *Operation of Transmitter Section*

In this transmitter section is used to transmit the serial data through power line carrier communication modem. Here it act as transceiver mode. URQ-1120 series power line carrier data transceiver module is connected between power line and microcontroller driver circuit. Here some of the basic codes of data are been stored for controlling the train. And also it can receive the information or data from the train that if an any emergency.

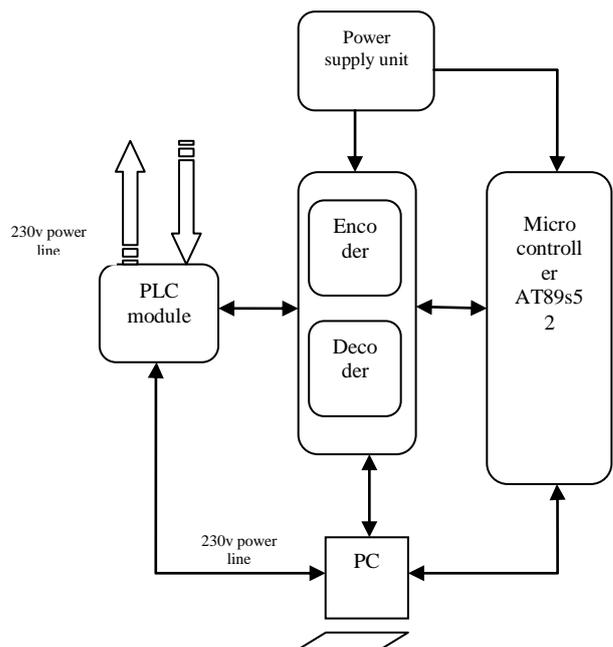


Figure 1. Block Diagram of Transmitter section

The modem has connected to pc for data transmission and reception. This data is transmitted in the secure way, It is that encryption and the decryption. The microcontroller is interfaced with because for any external use in the future updating and all the basic commands are stored in it which is controlling the whole unit.

The power supply is common. This circuit is connected to the power line which is also connected to the train. The transmitter section is mainly used receiving the information or data from the train. Transmitter section is also placed in station and as well as substations.

C. Receiver Section

- This can be processed at both automatic and manual.
- The Track detection and fire sensors are used sense for emergency message worked in automatic.
- The motor control driver is used for control the train speed and if any track error detected.
- It will be automatically slow down the speed and also convey the message to driver and to junction.

D. Operation of Receiver Section

Here, The Receiver section is placed in the train. In this section it will receive the instruction from the junction or station and also it can pass the information to junction if it needed. In the receiver section it contains some sensors for avoiding accidents and some other effects to us. So we used fire detector sensor for detecting the fire and it will automatically intimate to train driver and station. Then the track detection sensor are used for avoiding train accident and if it detects it will automatically slow down the train speed with intimating for both train driver and station that there is an crack in the track so please stop the train. For the station it will intimate the place where the track has cracked and says to repair the track. These functions are done by using Atmel microcontroller.

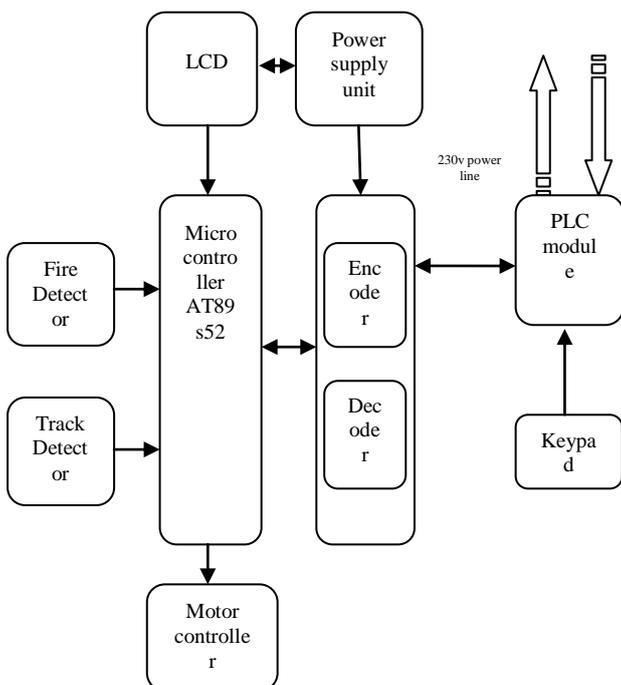


Figure 2. Block Diagram of Receiver Section

In this section also same as transmitter, it will transfer and receive the data or information with the security of encryption and decryption But in train we used the LCD display for sending and receiving the information or data. It also contains the keypad for sending the data or information in the emergency purpose.

VI. SOURCE AND SYSTEM ANALYSIS

A. The core module: PLC modem

Power line modem is useful to send and receive serial data over existing AC mains power lines of the building. It has high immunity to electrical noise persistence in the power line and built in error checking so it never gives out corrupt data. The modem is in form of a ready to use circuit module, which is capable of providing 9600 baud rate low rate bi-directional data communication. Due to its small size it can be integrated into and become part of the user's power line data communication system. Features are,

- Transmit and Receive
- serial data at 9600 bps
- Powered from 5V
- Low Cost & Simple to use
- Direct interface with Microcontroller uart txd, rxd pins

B. Atmel AT89S52

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8Kilo bytes of in-system programmable Flash memory. All four ports in the AT89C51 and AT89C52 are bidirectional. Each consists of a latch (Special Function Registers P0 through P3), an output driver, and an input buffer. The output drivers of Ports 0 and 2, and the input buffers of Port 0, are used in accesses to external memory[5].

All the Port 3 pins, and two Port 1 pins (in the AT89C52)are multifunctional[5]. Atmel AT89S52 is a powerful microcontroller which provides a highly flexible and cost-effective solution to many embedded control applications.

C. Serial Communication unit (and MAX 232 IC)

- Our microcontroller has a built in USART (Universal Serial Asynchronous Receiver Transmitter). Pins 3.0 and 3.1 of port 3 are also Transmitter and Receiver.
- These pins are used to communicate with any serial character. We shall use it to communicate with the PC via the RS232 port of the PC.
- The MAX 232 IC is used as an intermediate link between the PC and the Microcontroller IC, during serial Data communication. This is required as the PC RS232 port , MicroController serial pins communicate the serial Data(Emergency commends) using different logic systems[1].
- MAX232 IC receives a TTL level to convert, it changes a TTL logic 0 to between +3 and +15 V, and changes TTL logic 1 to between -3 to -15 V, and vice versa for converting from RS232 to TTL[5].

VII. ROUTING ALGORITHM

A. Artificial Cobweb Routing Algorithm

For long distance data transmission through power line we use the traditional polling algorithm. This method does not

finished successfully. Because it has some drawback. So that we cant communicate direct path via base station(BS).The possible method of data transmission rate is very poor. So, instead of using Traditional polling algorithm we use Artificial Routing Cobweb Algorithm, Which transfer the for long distance successfully.

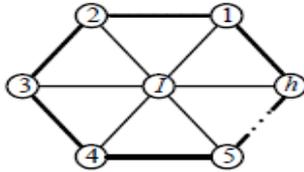


Figure 3. Single layer Artificial Cobweb Routing Algorithm

Assuming that the physical link is connected , we stipulate that[6]:

- All nodes in the networking process are responsible for recording the Physical signal strength β of the received information.
- Any node within the network can communicate with at least one other Node.
- Each node attempts to find the possible number of nodes in a maximum physical range.
- The logical ID of the BS is 0, and the nodes which have been assigned logical ID is no longer involved in the new logical ID allocation process.

VIII. FLOW CHART FOR PROPOSED CONCEPT

A. Flow Chart for Transmission Section

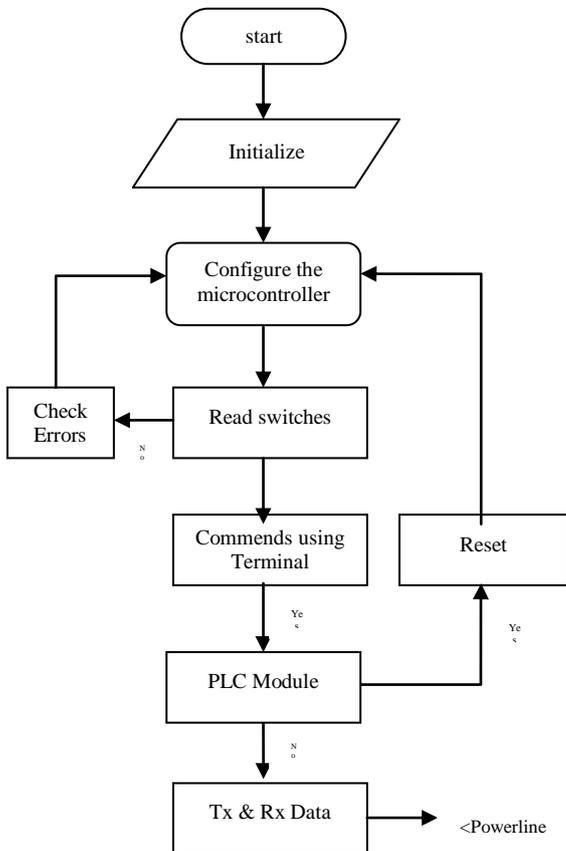


Figure 4. Flow Chart for Transmission Section

B. Flow Chart for Receiver Section

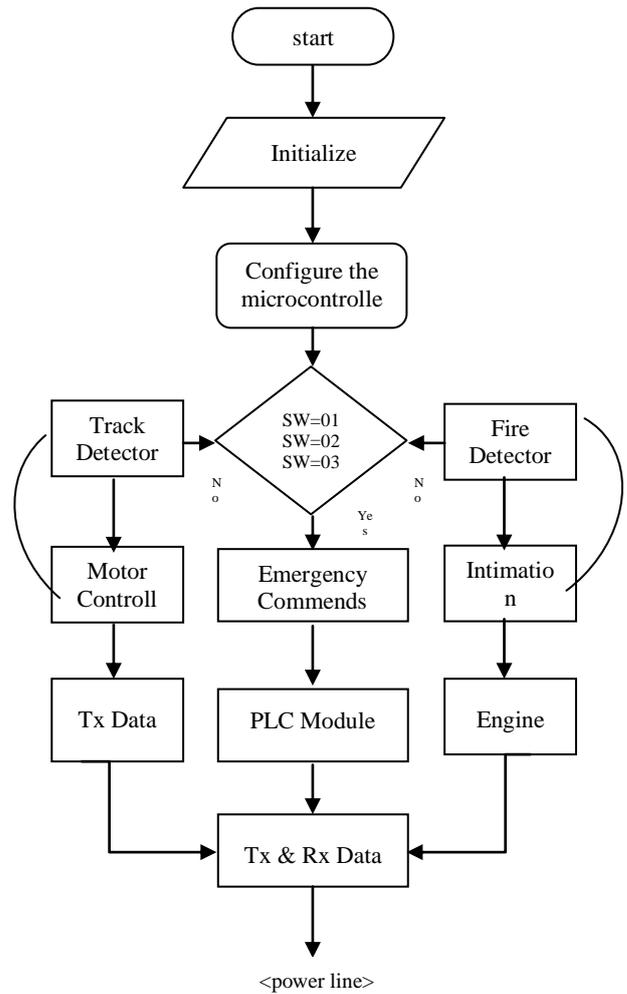


Figure 5. Flow Chart for Receiver Section

IX. ADVANTAGE OF PROPOSED METHOD

- It used to transmit the data for long distance without any loss.
- Data also transmit and receive in single power line.
- Here train also move with same power line.
- This transmission is done along high security.

X. CONCLUSION

This proposed data transmission using power line has very usefull for railways as well as it can also implemented in other application. Due to the fast and secure transmission of data we can communicate easily & rapid and also we can avoid the accidents etc. The advantages of this model are, Automation of all features including communication from the Train to junction. Data Transmission using both automatic and manual control. It involves less cost to communicate and this system increases productivity.

FUTURE RESEARCH

After having tried with several practical URQ-1120F experiments, further steps will be explore other powerline systems (like Lonwork or Konnex) to test their potentialities, also conducting a comparative study on the power consumes.

Another key point remains in any case the world of domotic control interfaces for disabled people, so our efforts will be again concentrated on this topic.

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