University of Mumbai

Insert Project Name

Submitted in partial fulfillment of requirements
for the degree of
Bachelors in Computer Engineering

by

Name of Student1(TE1/TE2) Roll No
Name of Student1(TE1/TE2)Roll No
Name of Student1(TE1/TE2) Roll No,
Name of Student1(TE1/TE2)Roll No

Guide:
Guide Name
Designation

ATHARVA
COLLEGE OF ENGINEERING

Department of Computer Engineering
Atharva College Of Engineering,
Malad West, Mumbai-95
University of Mumbai

Batch 2022-2026

AET's

Atharva College of Engineering, Mumbai-95

Certificate

This is to certify that Mini Project entitled ***insert project name*** is a bonafide work of **"Name of the student" (Roll no)**submitted to the University of Mumbai in partial fulfillment of the requirements for the award of the degree of "Bachelors of Engineering" in Computer Engineering.

—————————————
(Name and sign)
Guide

—————————————
(Name and sign)
External Examiner

College Seal

—————————————
(Name and sign)
Internal Examiner

—————————————
(Name and sign)
HOD,CMPN

—————————————
(Name and sign)
principal

Certificate of Approval of Examiners

The Mini Project report entitled ***insert project name*** by **Name of Student** is approved for the award of Bachelors Of Engineering Degree in **Computer Engineering**.

_____
Internal Examiner

_____
External Examiner

Date:
Place: Mumbai-95

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or work have been included. I have adequately cited and referenced the original source. I also declare that I have adhered to all principles of academic honesty and integrity and have not misinterpreted or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke the penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

_____
Signature

_____
Name Of Student
and Roll No

Date:

Place: Mumbai-95

Abstract

The 500 word abstract shall highlight the important features of the project report and shall correspond to the electronic version to be submitted to the Library for inclusion in the website.

Contents

List of Figures

List of Tables

List Of Abbreviations

BMS	Battery Management System
isoSPI	Isolated SPI communication
OCV	Open-Circuit Voltage
PEC	Packet Error Code
HV	High Voltage
LV	Low Voltage
SAE	Society of Automotive Engineers
AUTOSAR	AUTomotive Open System ARchitecture
VCU	Vehicle Control Unit
ECU	Electronic Control Unit
EMI	Electromagnetic Interference
RWD	Rear Wheel Drive
LCS	Launch Control System
TCS	Traction Control System
PMSM	Permanent-Magnet Synchronous Motor
CAN	Controller Area Network
SPI	Serial Peripheral interface
UART	Universal Asynchronous Receiver/Transmitter

Chapter 1

Introduction

Give at least two to three sentences about your project ...

1.1 Desciption

The main functionality of the project should be explained in brief. For reference see figure 1.1, equation 1.1, and table 2.1. For citations use [1] [2].

PID equation:

$$u(t) = K_p \, e(t) + K_i \, \int_{t_0}^{t} e(t') \, dt' + K_d \, \frac{de(t)}{dt}$$

Figure 1.1: Sample image

1.2 Problem Formulation

Explain the problem.

1.3 Motivation

(need of the project)List the various approached along with its drawbacks for solving the problem and briefly explain the approach used for your project.

1.4 Proposed Solution

Explain the method/technique used for solving the problem and how it overcomes the drawbacks mentioned under heading 1.3. Also explain how the project is going to help end users.

1.5   Scope of the Project

(scale/range of your project): Extent of how far your project can be completed. This can be in terms of domain or application related constraints/limitations.

Chapter 2

Literature review

(include at least 3IEEE or similar reputed technical papers as reference) Should be at least 3-4 pages which gives the ideas referenced by the reference papers. Mark the references wherever appropriate. (Note: - Please don't write the paper titles and the abstract of papers.)

xx	yy
aaa	aaa aaa aaa
bbb	bbb bbb bbb

Table 2.1: Sample table

Chapter 3

System Analysis

3.1 Functional Requirements

(write requirements of the project) Should follow the IEEE SRS format
(Software requirement specification format)

3.2 Non Functional Requirements

Should follow the IEEE SRS format

3.3 Specific Requirements

(Hardware and software requirements)

3.4 UseCase Diagrams and description

(Application development projects use-case is mandatory)

Chapter 4

Analysis Modeling

4.1 Data Modeling

(E-R Model if any with its associated Data dictionary) Applicable for those applications which are dependent on data storage and retrieval. ER Diagram normalized till the third normal form accompanied by the respective data dictionary table should be included

4.2 Activity Diagrams / Class Diagram

Depending on the type of your project you may include any of the diagrams.

4.3 Functional Modeling

(DFDs with specifications)mandatory for all projects

Chapter 5

Project design

5.1 Architectural Design

(Project Flow /architecture with description)

5.2 User Interface Design

GUI for your project

Chapter 6

Implementation

6.1 Algorithms / Methods Used

Mention your algorithms if any or any methodology used.

6.2 Working of the project

(code for mentioned algorithms)

Chapter 7

Results

(final results or outputs)

Chapter 8

Conclusions and Future Scope

8.1 Conclusion

Conclusion

8.2 FutureScope

Futute Scope

Bibliography

[1] Brian Douglas. *Understanding PID Control*. 2020. URL: https://www.mathworks. com/videos/series/understanding-pid-control.html.

[2] Tanya Garg and Surbhi Khullar. "Big Data Analytics: Applications, Challenges and Future Directions". In: *2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)*. 2020, pp. 923–928. DOI: 10.1109/ICRITO48877.2020.9197797.

Journal

M2M Communication - Power Link Technology

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Abstract— We are describing about M2M communication.M2M communication is nothing but machine communicates with each other. They can send and receive data between each other. In our project we are using 2 Raspberry pi B+ as client and server. One machine acts as a server (MN) and another acts as a client (CN). Raspberry pi has more important features, so we are using it. To have the faster communication between these we use Powerlink protocol stack. It helps in transmission of time critical data. It is faster than Ethernet. Because of these reasons these solutions are commonly referred to as "real-time industrial Ethernet" technologies. POWERLINK is now considered as one of the most successful real-time industrial Ethernet system.

Key words: Computer Network, Wired and Wireless Communication, Powerlink Protocol Stack

I. INTRODUCTION

In today's world everyone wants fast data transfer. There are various technologies which are helping in fast data transfer .we are using PowerLink protocol stack. PowerLink stack helps us in sending time critical data .It helps to send data faster than Ethernet .Powerlink is one network for all. This protocol stack is implemented on any type of device. It is easy to understand.

PowerLink protocol stack provides many important features like hot plugging, easy installation and choice of network topology. We are implementing PowerLink protocol stack on Raspberry pi B+. Raspberry pi is easy to use ,It's having linux as its operating system.Linux have less delay as compared to windows so we are using linux and.
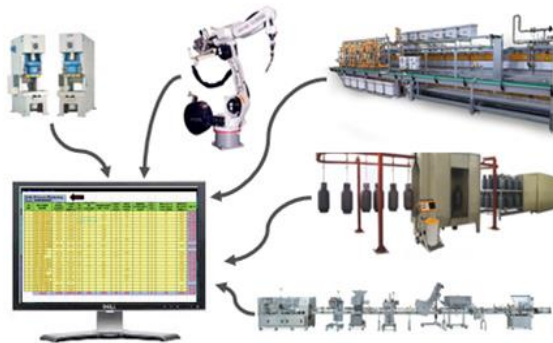
II. M2M

Fig. 1: Machine to Machine Communication

Machine-to-Machine(M2M) communication can be said as it is a form of data communication that involves one or more objects that do not mandatorily require human intervention in their communication process. M2M is also named as Machine Type Communication (MTC) and it is completely different from the current communication models in the such way that it involves:

− New market scenarios.
− Less costs.
− Less effort.
− Very large number of communicating terminals.
− little traffic per terminal.

With tremendous amount of growth in M2M large amount of devices are connected with each other.The connectivity is embedded into day-to-day lives.These devices can send or receive data among each other at particular time interval.

A. Key features of M2M

Following are the key features of M2M communication system are given below:

a) Low Mobility: M2M Devices move only within a certain region.
b) Time Controlled: These devices send or receive data only at specific periods
c) Packet Switched : Here Network operator to provide packet switched service with or without an MSISDN
d) Online small Data Transmissions: M2M Devices frequently send or receive small amounts of data.
e) Low Power Consumption: To improve the ability of the system to efficiently service M2M application.

B. Applications of M2M

The applications of M2M covers multiple areas and the areas in which M2M is used currently are given below:

a) Tracing and Tracking:, Order Management, Fleet Management pay as you drive,its also used in Asset Tracking, Navigation, Traffic optimization/steering, Traffic information, Road tolling.
b) Payment: Point of sales, Vending machines, Gaming machines
c) Secured connections: It is used in Surveillances, Alarm systems, Access control, Car/driver security.
d) Health: Monitoring important signs, Supporting the aged or handicapped, Web, Remote diagnostics, Access Telemedicine points
e) Remote Maintenance/Control: Lighting, Sensors,Pumps, Valves, Elevator control, Vending machine control, Vehicle diagnostics

III. POWERLINK

Over the course of the last two decades, it has become very hard to keep track of the many fieldbus systems that are developed in the industry of automation specifically for different purposes of factory production control process and. Yet there remain various constraints that are impeding their performance. Demand has become more pressing for a reliable communication system that offer high flexibility and also across-the-board compatibility. A new solution in this seam was also expected to allow for ongoing improvements and upgrades in future. Ethernet was the 1st to rise to this challenge: it was a tested and tried technology that widely standardized to boot and was free of patents. Moreover, it had tremendous potential to serve as a consistent, integrated solution of communication that could be supported for the interconnection of the process, control and field levels. Nevertheless, when standard Ethernet is combined with an

Internet protocols like TCP and IP is unsuitable for data transmission in hard real time. It is also possible that Data traffic can also be delayed in unforeseeable ways due to the CSMA/CD Detection mechanism. An integral part of the Ethernet standard IEEE 802.3, this helps prevent data collisions on the bus that can happen in Ethernet environments due to the nature of Ethernet transmissions. In order to progress Ethernet-based, but real-time capable fieldbuses, manufacturers have pursued various approaches in their so that delays can be eliminated.It (PowerLink) has now become one of the most successful real-time Ethernet for industries systems in the today's world.
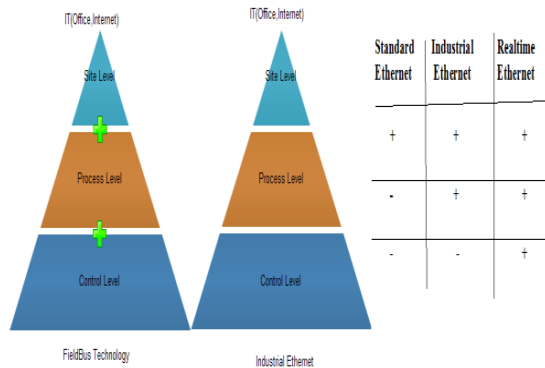

Fig. 2: Industrial Ethernet

With more than 1.1 million POWERLINK systems that are installed, POWERLINK is the worldwide leader for real-time Ethernet results. Complete openness, max performance and unmatched features are the reasons for POWERLINK's success. POWERLINK will sake from the long term evolution of Ethernet technology without even requiring any further investment. POWERLINK fully supports standard TCP/IP protocols. It supports because of the fact that TCP/IP runs on a dedicated communication channel, it ensures that guaranteed bandwidth for TCP/IP without affecting hard real-time data exchange.Based on standard Ethernet the EPSG decision is to standardize a technology fully acquiescent with IEEE 802.3 is a safe choice for the future.
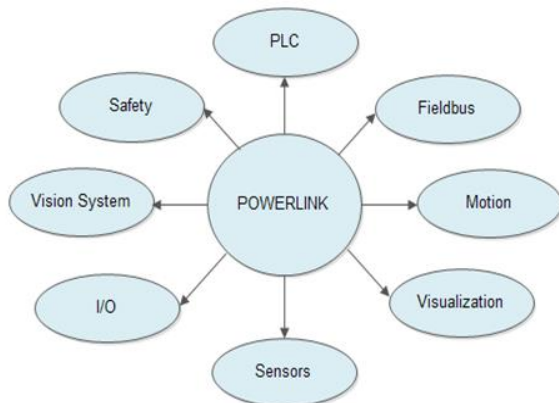

Fig. 3: PowerLink Features

POWERLINK will sake from the long-term evolution of Ethernet technology without requiring any further investment. It has unmatched features Carrying together Ethernet, CANopen, and hard real-time capabilities, POWERLINK integrates advantages and features from 3 different worlds.

The core of POWERLINK technology includes numerous unmatched features -
a) Redundancy
b) hot plugging
c) direct cross-traffic
d) multiplexing
e) poll response chaining

Maximum performance POWERLINK provides max performance with cycle time down to 100 µs and system synchronization is also below 100 ns. In addition to being able to connecting up to 240 nodes in a single network, POWERLINK networks can be connected and can be fully synchronized to infinitely expanding networking capabilities.

A. Open POWERLINK Stack

The open POWERLINK stack is a POWERLINK stack that is developed by SYS TEC electronic. SYS TEC they published the POWERLINK stack under the Open-Source BSD license. It (open POWERLINK) contains all services and functionalities that are required for implementing a POWERLINK MN and CN. PowerLink supports multiple operating systems and platforms like Linux, Windows and other .Although there are Linux solutions that available for other Ethernet based fieldbuses, these are mostly Linux drivers for proprietary hardware and with the OpenPOWERLINK stack a pure software based solution that is available which works on a standard PC and no proprietary hardware is needed.
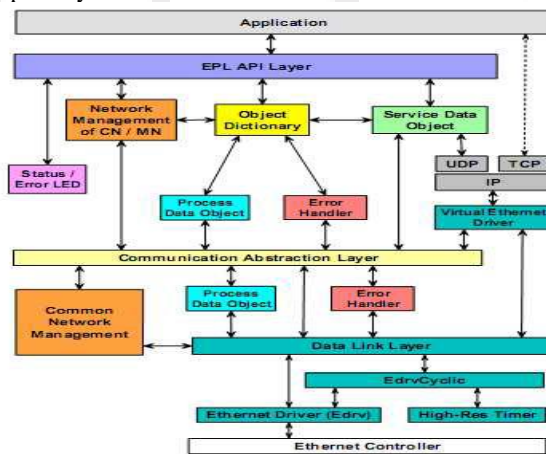

Fig. 5: Open Powerlink Software Architecture

IV. EVALUATING THE PERFORMANCE

A. Industrial Ethernet On Raspberry Pi Industrial Ethernet

POWERLINK An Industrial Ethernet protocol that allows to deterministically exchange that process data in real time. POWERLINK is the only hard real-time Industrial Ethernet protocol is available in Open Source for both, i.e.Master and Slave configurations. It is based on standard Ethernet and consequently runs on any kind of hardware and software platform.

B. Raspberry Pi2

The Raspberry Pi2 can be considered as a small and cheap single-board PC. Apart from the ARM Coretex-A7 quad-core , CPU peripherals such as some GPIOs and an Ethernet port are also available on the board. Due to its low prize and

wide availability, the Raspberry Pi2 B+ is an perfect platform for small and home automation projects Because it has more powerful features like:

1) More GPIO: The GPIO header has grown to 40 pins, while maintaining the same pin out for the 1st 26 pins as the Model A and Model B.
2) More USB: We are now having 4 USB 2.0 ports, which is compared to 2 on the B Model , and better hotplug and over current behavior.
3) Lower power consumption. By substituting linear regulators with switching ones we have reduced power consumption between 0.5W and 1W.
4) Micro SD:The old friction-fit SD card socket which is replaced with a much nicer push-push microSD version.

C. Network Architecture

In our project, the openPOWERLINK master is connected to two openPOWERLINK slaves by using a switch or a router. A PC which is consisting of windowscan is also possible to be connected to the switch for capturing the packets from the POWERLINK network.Basically in our project ,we are trying to make shop floor more intelligent by using embedded device like Raspberry pi B+ .It will capture data at microseconds in order to keep track of products developed. The data is collected using sensors like RTD,Thermocouple and that data is stored in the PC. In this case,we are using 2 Rasberry Pi B+ one will act as a MN and other will be acting as slave(CN).It is basically a client-server application.
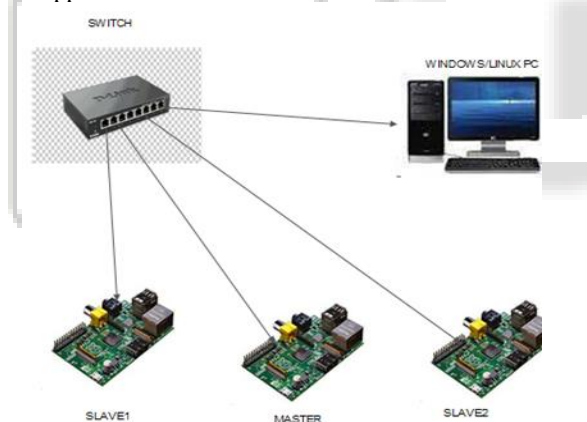

Fig. 6: Network architecture: open POWERLINK on Raspberry Pi2

V. Advantages

1) Manager paperless shop floor: Now-a-days shop floors are usually handled by keeping the records of the products delivered at a particular time. This record may be biased as it is entered by supervisor.
2) Ensure Consistency: The data collected is consistent.
3) Less prone to errors: The collected data is timely and accurate.

VI. Applications

1) Intelligent ShopFloor -Here in this project, we are actually making intelligent shopfloor.
2) Telemedicine
3) Traffic Control
4) Industry Servicing

VII. Conclusion

We have used Power Link technology for communication between two devices. Planning and development of the network transmission is integral to Powerlink. Powerlink is continuing to develop its engagement process with non-network providers and where possibly expand the use of non-network solutions to address all future limitations within the transmission network. Powerlink has responded to feedback by providing enhanced information on non-network alternatives. Powerlink will also continue to request non-network results from market participants. . M2M communication is the PowerLink protocol stack. It is middleware between the application and hardware. Creating the PowerLink protocol stack and sending, receiving the data packets between MN and CN.Hence we have successfully implemented intelligent client-server relation in two Raspberry Pi.

VIII. Future scope

We will try to implement this on shopfloor to make it more intelligent.Today shopfloors are managed by taking records of products at a particular time. These record may be biased. For having the transparency in the workers and management at the top .In this scenerio, it will give details about the products to top management whenever they request for it. It will provide details about the products that have been developed on particular time. So management will get correct data and it is not biased. It is a very helpful solution.

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Conference

Acknowledgements

Some text ...