

## **Microcontroller Based Substation Monitoring and Control System with Gsm Modem**

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**Abstract :** *The purpose of this project is to acquire the remote electrical parameters like Voltage, Current and Frequency and send these real time values over GSM network using GSM Modem/phone along with temperature at power station. This project is also designed to protect the electrical circuitry by operating an Electromagnetic Relay. This Relay gets activated whenever the electrical parameters exceed the predefined values. The Relay can be used to operate a Circuit Breaker to switch off the main electrical supply.*

*User can send commands in the form of SMS messages to read the remote electrical parameters. This system also can automatically send the real time electrical parameters periodically (based on time settings) in the form of SMS. This system can be designed to send SMS alerts whenever the Circuit Breaker trips or whenever the Voltage or Current exceeds the predefined limits.*

*This project makes use of an onboard computer which is commonly termed as microcontroller. This onboard computer can efficiently communicate with the different sensors being used. The controller is provided with some internal memory to hold the code. This memory is used to dump some set of assembly instructions into the controller. And the functioning of the controller is dependent on these assembly instructions. The controller is programmed using Embedded C language.*

**Keyword:** *GSM Modem, Initialization of ADC module of microcontroller, PIC-C compiler for Embedded C programming, PIC kit 2 programmer for dumping code into Micro controller, Express SCH for Circuit design, Proteus for hardware simulation.*

### **I. Introduction**

Electricity is an extremely handy and useful form of energy. It plays an ever growing role in our modern industrialized society. The electrical power systems are highly non-linear, extremely huge and complex networks [1]. Such electric power systems are unified for economical benefits, increased reliability and operational advantages. They are one of the most significant elements of both national and global infrastructure, and when these systems collapse it leads to major direct and indirect impacts on the economy and national security [2]. A power system consists of components such as generators, lines, transformers, loads, switches and compensators. However, a widely dispersed power sources and loads are the general configuration of modern power systems [3]. Electric power systems can be divided into two sub-systems, namely, transmission systems and distribution systems. The main process of a transmission system is to transfer electric power from electric generators to customer area, whereas a distribution system provides an ultimate link between high voltage transmission systems and consumer services. In other words, the power is distributed to different customers from the distribution system through feeders, distributors and service mains. Supplying electricity to consumers necessitates power generation, transmission, and distribution [4]. Initially electric power is generated by using electric generators such as: nuclear power generators, thermal power generators and hydraulic power generators and then transmitted through transmission systems using high voltage. Power departs from the generator and enters into a transmission substation, where huge transformers convert the generator's voltage to extremely high voltages (155kV to 765 kV) for long-distance (up to about 300 miles) transmission [4]. Then, the voltage level is reduced using transformers and power is transferred to customers through electric power distribution systems. Power starts from the transmission grid at distribution substations where the voltage is stepped-down (typically to less than 10kV) and carried by smaller distribution lines to supply commercial, residential, and industrial users [4]. Novel electric power systems encompassing of power transmission and distribution grids consist of copious number of distributed, autonomously managed, capital-intensive assets. Such assets comprise: 1.) power plants, 2.) transmission lines, 3.) transformers, and 4.) protection equipment [1].

Electric utility substations are used in both the transmission and distribution system and operate independently to generate the electricity. A typical substation facility consists of a small building with a fenced-in yard that contains transformers, switches, voltage regulators, and metering equipment that are used to adjust voltages and monitor circuits [4]. A reliable and efficient process of these networks alone is not very significant when these electricity systems are pressed to their parameters of its performance, but also under regular operating conditions. Generators and loads are some components that coerce the continuous dynamic behavior [5].

# Microcontroller Based Substation Monitoring And Control

**Mark Steyvers**



## **Microcontroller Based Substation Monitoring And Control:**

**Smart Grids for Smart Cities, Volume 2** O. V. Gnana Swathika, K. Karthikeyan, Sanjeevikumar

Padmanaban, 2023-06-06 SMART GRIDS for SMART CITIES Written and edited by a team of experts in the field this second volume in a two volume set focuses on an interdisciplinary perspective on the financial environmental and other benefits of smart grid technologies and solutions for smart cities This second volume in this groundbreaking two volume set continues the authors and editors mission to present the concepts and best practices of smart grids and how they can be utilized within the framework of a technological tapestry to create smart cities Continuing to go through the challenges and their practical solutions this second volume includes chapters on waste management e waste automotive and transportation engineering and how internet of things can be utilized within these smart technologies and many others Like its predecessor this exciting new volume covers all of these technologies including the basic concepts and the problems and solutions involved with practical applications in the real world Whether for the veteran engineer or scientist the student or a manager or other technician working in the field this volume is a must have for any library *ITSPWC 2022* S. Kannadhasan, R.

Nagarajan, George Ghinea, Alagar Karthick, Basim Alhadidi, Kanagaraj Venusamy, 2022-08-04 We are delighted to introduce the proceedings of the first edition of the 2022 International Conference on Intelligent Technologies in Security and Privacy for Wireless Communication ITSPWC 2022 This conference has brought researchers developers and practitioners around the world who are leveraging and developing the Wireless Communication The theme of ITSPWC 2022 was Security and Challenges for Wireless Communication and Power Energy The technical program of ITSPWC 2022 consisted of 33 full papers including 5 invited papers in oral presentation sessions at the main conference tracks The conference tracks were Track 1 Recent Trends in IoT Track 2 Recent Trends in Smart Energy Systems and Transmission Track 3 Recent Trends in Embedded Systems and Track 4 Recent Trends in Communication Systems Aside from the high quality technical paper presentations the technical program also featured one invited talk and two technical workshops The invited talk was presented by Prof Kaushik Pal from Universidade Federal do Rio de Janeiro Brazil The ITSPWC workshop aimed to gain insights into key challenges understanding and design criteria of employing wireless technologies to develop and implement future related services and applications It was a great pleasure to work with such an excellent organizing committee team for their hard work in organizing and supporting the conference In particular the Technical Program Committee led by our Co Chairs Dr R Nagarajan Dr George Ghinea Dr Alagar Karthick Dr Bassim Alhadidi and Prof Kanagaraj Venusamy who have completed the peer review process of technical papers and made a high quality technical program We are also grateful to all the authors who submitted their papers to the ITSPWC 2022 conference and workshops We strongly believe that ITSPWC conference provides a good forum for all researcher developers and practitioners to discuss all science and technology aspects that are relevant to Security and Privacy in Wireless Communication We also expect that the future Wireless

Communication conference will be as successful and stimulating as indicated by the contributions presented in this volume  
Dr S Kannadhasan **IoT and Analytics in Renewable Energy Systems (Volume 2)** O.V. Gnana Swathika,K.

Karthikeyan,Sanjeevikumar Padmanaban,2023-08-11 Smart cities emanate from a smart renewable energy aided power grid  
The smart grid technologies offer an array of benefits like reliability availability and resiliency Smart grids phenomenally  
contribute to facilitating cities reaching those sustainability goals over time Digital technologies such as the Internet of  
Things IoT automation artificial intelligence AI and machine learning ML significantly contribute to the two way  
communication between utilities and customers in smart cities Five salient features of this book are as follows Smart grid to  
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smart transportation smart home smart agriculture smart manufacturing smart grid smart education smart government  
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Challenges and future research directions of smart city applications **ICAE 2022** Prasaja Wikanta,Alena

Uperati,Abdurahman Dwijotomo,2023-06-28 This is proceeding for the 5th International Conference on Applied Engineering  
ICAE 2022 held online in Batam Indonesia on 5 October 2022 ICAE is an annual conference organized by Politeknik Negeri  
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Devices and other related fields All submission were peer reviewed with at least 3 reviewers provided for each paper A total  
of 37 selected which is around 58% acceptance rate We express gratitude to all who contributed to the success of ICAE 2022  
We acknowledge the invaluable assistance of the track chairs and the track program committee members It required the  
significant efforts of many people to make this virtual conference possible especially in this time of COVID 19 pandemic We  
thank the Organizing Committee members along with the numerous reviewers for their assistance with the reviews of the  
submitted manuscripts These reviewers serve to bring a broad set of perspectives to the research arena We especially thank  
the authors who have provided the submitted manuscripts The quality of these papers is a tribute to the authors and also to  
the reviewers who have guided any necessary improvement Last but not least we are greatly indebted to the three keynote  
speakers Prof Yusep Rosmansyah S T M Sc Ph D from Information Technology Research Division KKTi School of Electrical  
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keynote speeches in this conference We hope this ICAE proceeding will have impact to the research community in the longer

term **Microcomputer Applications** ,1990 Science Abstracts ,1995 **Information and Automation** Luo Qi,2011-04-15 This book constitutes the refereed proceedings of the International Symposium on Information and Automation ISIA 2010 held in Guangzhou China in November 2010 The 110 revised full papers presented were carefully reviewed and selected from numerous submissions The symposium provides a forum for researchers educators engineers and government officials to present and discuss their latest research results and exchange views on the future research directions in the general areas of Information and Automation **Electrical & Electronics Abstracts** ,1997

**Proceedings of the 21st International Conference on Power Industry Computer Applications** IEEE Power Engineering Society,ABB Asea Brown Boveri Ltd,1999 IEEE Catalog Number 99CH36351 verso of T p *Conference Proceedings* ,1999 *Index to IEEE Publications* Institute of Electrical and Electronics Engineers,1998 Issues for 1973 cover the entire IEEE technical literature *Microcontroller-Based Temperature Monitoring and Control* Dogan Ibrahim,2002-10-08 Provides practical guidance and essential theory making it ideal for engineers facing a design challenge or students devising a project Includes real world design guides for implementing a microcontroller based control systems Requires only basic mathematical and engineering background as the use of microcontrollers is introduced from first principles Engineers involved in the use of microcontrollers in measurement and control systems will find this book an essential practical guide providing design principles and application case studies backed up with sufficient control theory and electronics to develop their own systems It will also prove invaluable for students and experimenters seeking real world project work involving the use of a microcontroller Unlike the many introductory books on microcontrollers Dogan Ibrahim has used his engineering experience to write a book based on real world applications A basic mathematical and engineering background is assumed but the use of microcontrollers is introduced from first principles *Microcontroller Based Temperature Monitoring and Control* is an essential and practical guide for all engineers involved in the use of microcontrollers in measurement and control systems The book provides design principles and application case studies backed up with sufficient control theory and electronics to develop your own systems It will also prove invaluable for students and experimenters seeking real world project work involving the use of a microcontroller Techniques for the application of microcontroller based control systems are backed up with the basic theory and mathematics used in these designs and various digital control techniques are discussed with reference to digital sample theory The first part of the book covers temperature sensors and their use in measurement and includes the latest non invasive and digital sensor types The second part covers sampling procedures control systems and the application of digital control algorithms using a microcontroller The final chapter describes a complete microcontroller based temperature control system including a full software listing for the programming of the controller Conference Proceedings IEEE Power Engineering Society. General Meeting,2003 **Electrical World** ,1994 **Fourth International Conference on Advances in Power System Control, Operation & Management,**

**11-13 November 1997** ,1997    **Applied Science & Technology Index** ,1995    **Microcomputers** Engineering  
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## **Table of Contents Microcontroller Based Substation Monitoring And Control**

1. Understanding the eBook Microcontroller Based Substation Monitoring And Control
  - The Rise of Digital Reading Microcontroller Based Substation Monitoring And Control
  - Advantages of eBooks Over Traditional Books
2. Identifying Microcontroller Based Substation Monitoring And Control
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Microcontroller Based Substation Monitoring And Control
  - User-Friendly Interface
4. Exploring eBook Recommendations from Microcontroller Based Substation Monitoring And Control
  - Personalized Recommendations
  - Microcontroller Based Substation Monitoring And Control User Reviews and Ratings
  - Microcontroller Based Substation Monitoring And Control and Bestseller Lists
5. Accessing Microcontroller Based Substation Monitoring And Control Free and Paid eBooks
  - Microcontroller Based Substation Monitoring And Control Public Domain eBooks
  - Microcontroller Based Substation Monitoring And Control eBook Subscription Services

- Microcontroller Based Substation Monitoring And Control Budget-Friendly Options
- 6. Navigating Microcontroller Based Substation Monitoring And Control eBook Formats
  - ePub, PDF, MOBI, and More
  - Microcontroller Based Substation Monitoring And Control Compatibility with Devices
  - Microcontroller Based Substation Monitoring And Control Enhanced eBook Features
- 7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Microcontroller Based Substation Monitoring And Control
  - Highlighting and Note-Taking Microcontroller Based Substation Monitoring And Control
  - Interactive Elements Microcontroller Based Substation Monitoring And Control
- 8. Staying Engaged with Microcontroller Based Substation Monitoring And Control
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Microcontroller Based Substation Monitoring And Control
- 9. Balancing eBooks and Physical Books Microcontroller Based Substation Monitoring And Control
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Microcontroller Based Substation Monitoring And Control
- 10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
- 11. Cultivating a Reading Routine Microcontroller Based Substation Monitoring And Control
  - Setting Reading Goals Microcontroller Based Substation Monitoring And Control
  - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Microcontroller Based Substation Monitoring And Control
  - Fact-Checking eBook Content of Microcontroller Based Substation Monitoring And Control
  - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
  - Utilizing eBooks for Skill Development
  - Exploring Educational eBooks
- 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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