

A Raspberry Pi Based Global Industrial Process Monitoring through Wireless Communication

Priyanka S Lonare¹, Dr. Mahesh Kolte²

Department of ENTIC, MIT COE, University of Pune, India¹

Professor, Department of ENTIC, MIT COE, University of Pune, India²

Abstract: In recent research work the Wireless technologies are being more and more used in automation and also in the field of wireless communications are diverse. The advancement in wireless technology offers a good opportunity in the area of communication in perfect region. When the embedded devices are provided with internet access the demand will rise due to the remote accessing capability of these devices. Users can monitor & control remote systems by using embedded Easy IOT server. Wireless based industrial automation is a prime concern in our day-to-day life. The approach to Wireless Network for Industrial Applications standardized nowadays. Intelligent and low-cost automation of industrial processes are crucial in order to improve process efficiencies, deliver quality products, and ensure timeliness and accuracy of systems. Wireless is predicted to be one of the fastest growing technologies in the area of process automation sector. This paper is focused on design & implementing a secured wireless communication system of ARM embedded IOT server based on Raspberry Pi. For effective designing & implementing a system we use wireless technology. This wireless technology along with router makes the system Accessible from anywhere in the world. Various Sensors are interfaced with microcontroller. Parameters like Temperature, gas, motion, distance, humidity are measured & real time sensed data is available on the remote pc as well as on the android Smartphone. Due to the use of wireless technology we can achieve super speed transmission of large amount of data in very less time. As the overall system is based on generating of dynamic IP address every time, we can say that the system is much secured than all the previous systems. Thus Proper use of wireless sensor networks (WSNs) lowers the rate of failures, overall cost of the system, & increases the productivity, efficiency of overall industrial operations.

Keywords: Easy IOT Server, Raspberry Pi, Real Time, Arduino Wireless sensor networks, Industrial

I. INTRODUCTION

Society in the daily endeavors has become so dependent on automation. It is more difficult to imagine life without such a automation engineering in current environment. The system with addition to the industrial production with which it is popularly associated. Now it covers a number of unexpected areas in system research. In recent environmental protection engineering, traffic engineering, safe system, agriculture, building engineering, and medical engineering are but some of the areas where automation is playing a vital role as well application. In new approach of automation engineering is a cross sectional discipline where it mainly requires exact, proportional knowledge in hardware and software research development and their applications in particular field.

Past of topic automation engineering was mainly understood as control engineering dealing with a number of electrical and electronic components. Some applications are built to collect and send data through a modem to a server. Wireless based industrial automation is a prime concern in our day-to-day life. The approach to Wireless Network for Industrial Applications standardized nowadays. Intelligent and low-cost automation of industrial processes are crucial in order to improve process efficiencies, deliver quality products, and ensure timeliness and accuracy of systems.

Wireless is predicted to be one of the fastest growing technologies in the area of process automation sector. Industrial automation systems comprise of various field devices and technologies working in synchronization. These devices are responsible for a variety of functions related to Instrumentation, control, supervision and operational management system.

II. LITERATURE SURVEY

Mrutyunjaya Sahani, [et.al, 2015] the design and development of a new smart monitoring and controlling system for kitchen environment in real time developed with comparative good architecture.

As per explain in the paper proposes a new Raspberry pi based kitchen monitoring system through webpage with ZigBee based technology with detail.

In the designed and implemented a compact wireless sensor network with internet capability of environment. System can monitor the status of kitchen and send email and/or an alert SMS via GSM network automatically to users with detail data. It has the capability to control through internet. With the subject of received email is read by the developed algorithm fed into Raspberry pi and

then the system responds to the corresponding instruction with high security applicable. It has a variety of features such as energy efficient, intelligence, various low cost, portability and high performance. A concept of new technology used Raspberry pi based kitchen monitoring system through webpage with ZigBee based technology as explained in paper [1]

Ravi.M.et.al.[2015] As per author explain automation using in wireless communication has made the systems more smart and automated communication architecture. In the Technology used The Local Area Network this also sends an alerting SMS to a predefined mobile number. It may also remote system if a parameter crosses the threshold. In the proposed system, the patient's physiological conditions are acquired by the wireless sensors nodes attached on the patient body, and are then transmitted to the remote base-station. Base station is designed using a Raspberry Pi. The Raspberry Pi is basically ARM 11 processor with features like serial communication and Ethernet and so on. All features are explored to communicate with the WSN architecture to perfectly acquire data and update the status to doctor's chamber using LAN in respective order. In the Wireless Sensor Nodes designed using ZigBee is emerging as a significant element of next generation healthcare services. In this paper we proposed a mobile physiological monitoring system, which is able to continuously monitor the patient's heart beat, blood pressure and other critical parameters in the hospital. In entire system consists of a router node to acquire the patient's physiological data with systematic way. The transmitted data from the router node is received by the coordinator node. The coordinator node connected to the server. All the main nodes designed to update the data using LAN. It helps in easy way to monitor the patient at their chamber and helps doctors to take immediate actions on respective condition in particular research domain. [2]

Keerthi VallapReddy.et.al.[2014] In this paper author has proposed a completely automated license plate recognition system with detail diagram. In the aim of research at designing a system which automatically captures the image of the number plate of a vehicle. These details were verified using Raspberry Pi processor for authentication. The system also alerts the authorities when any unauthorized image of number plate was detected using buzzer alarm system. In the explanation when the authorized vehicle was detected then the system operates the gate using DC motor the related work. As automation is the most frequently spelled term in the field of electronics consider with research area. In the require for automation brought many revolutions in the existing technologies area. As per project direction it makes use of an onboard computer, which is commonly termed as Raspberry Pi processor as architecture. In a paper it acts as heart of the project. In the onboard computer can efficiently communicate with the output and input modules which are being used through all paper in research work. [3]

Fabio Leccese et.al.[2014] In paper A smart city application has been realized and tested in well manner. In paper fully remote controlled isle of lamp posts based on new technologies with architecture. As per the new designed and organized in different hierarchical layers system, which perform local activities to physically control the lamp posts and transmit information with another for remote control. Locally, each lamp post uses an electronic card in system for management and a ZigBee network. The new concept network transmits data to a central control unit, which manages the whole isle in research work. The central unit is realized with a Raspberry-Pi control card due to its good computing performance at very low price in system. The Smart City (SC) paradigm helps renovate the traditional city concept. In fact, it is possible to realize and develop efficient demand-side strategies integrating the monitoring and automation features ensured by intelligent devices and their communication apparatuses typically used in many applications. Within this concept, public lighting, being a great electrical energy consumer, has recently been attracting the interest of the research community. Scientists, combining the SC paradigm with alternative energies and new lighting technologies, are conceiving systems previously unimaginable, which can increase the efficiency obtaining considerable energy consumption savings and consequently money savings, a WiMAX connection was tested and used to remotely control the smart grid, thus overcoming the distance limitations of commercial Wi-Fi networks. The isle has been realized and tested for some months in the field. [4]

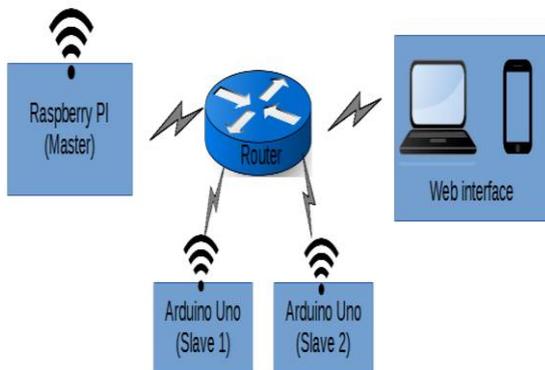
Oğuz Gora et.al.[2015] In recent years embedded systems have gained more importance. These systems are especially dedicated to specific tasks which are handled by highly optimized solutions. One of the interesting areas of embedded systems use is multi-media. Producing, processing, streaming various multimedia types and interacting with the physical environment is very common today. Similar to these studies, controlling and observing the specified area by multi-media tools are the necessities for many reasons such as security. This paper presents a method of video and photo recording of any moving object by using open source operation system (Raspbian- a distribution of Linux) and software (Python – a high-level programming language). The system is triggered by a motion sensor and it collects visual data from a specified area for limited duration. The collected data is published on internet via dedicated web site. The system works by itself but with a web interface many control abilities are possible program in Python operates the camera. [5]

V. Ramanath et.al.[2015] This paper focuses on the use of face recognition technique for Car ignition, as opposed to the natural method of using keys. Face recognition is a fast increasing, interesting areain real time applications. The face recognition methodology enables face recognition of valid users of the vehicle to be enrolled in a database. Before any user can access the car, the image of his face is

matched against the faces in the database. The users with no match in the database are prevented from accessing the vehicle. Haar features are used for object detection and Principal Component Analysis is used for face recognition. This work is implemented on Raspberry Pi microcontroller and this is very low cost system. we propose an embedded system that performs the Face Recognition using ARM1176JZF-S (Raspberry Pi) processor. This embedded system using Raspberry Pi has the feature of image or videoprocessing. So, our embedded system that detects the image with high speed. [6]

III PROPOSED WORK

Methodology used:

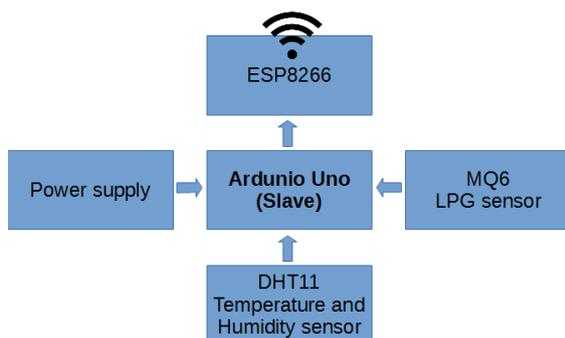


Block diagram description:

System consist of 4 major blocks i.e. Master, Slaves, router and web interface. Raspberry Pi is a master module consisting of raspbian jessie operating system. A web server 'Easyiot 9.0' is installed in the operating system. Slaves consist of Arduino Uno with sensors. For web interface we can use any computer or smart phone. Every other block has a wireless communication link with every other block. Raspberry Pi and we interface may have direct wired link depending upon requirement of application, but slaves are wireless nodes.

Slave 1

This node takes input from temperature and humidity sensor and gas sensor. DHT11 sensor gives calibrated digital output data for temperature and humidity. MQ6 gives analog output value for depending upon the gas concentration.



ESP8266 is a Wi-Fi module which contains SOC with TCP/IP protocol stack, though this Arduino can access Wi-Fi. This sensor node is powered by 9 volt battery. All generated data i.e. temperature, humidity and LPG concentration is sent to Easyiot server on the Raspberry Pi. If the LPG leakage is detected then alarm will be raised. In case of the temperature and humidity of environment changes then control measures can be taken. All the data readings will be logged in server.

Slave 2 :

This node takes input from PIR sensor and Ultrasonic distance sensor. HC-SR501 sensor detect motion of intruder and according to that alarm will be raised. HC-SR04 is used to check the current status of shutter i.e. open or closed, it can be used for other application as per requirements. ESP8266 is a Wi-Fi module which contains SOC with TCP/IP protocol stack, though this Arduino can access Wi-Fi . This sensor node contentiously monitor the motion changes and status of gate of the remotely located plant and data will be sent to server. If motion is detected in undesired time or Gate/door is opened illegally the alarm will be raised simultaneously activity log will be maintained at server.

IV. RESULTS

Data from the sensor nodes is stored on the Easyiot server. This data can be accessed by any authorized used from any lactation. The obtained data can be stored in various format and can be represented in graphical format, depending on day, week and month. Following figures shows obtained data and GUI.

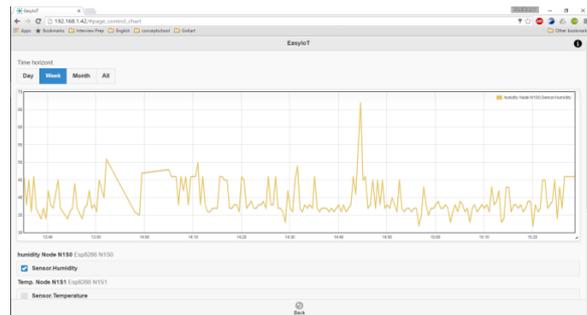


Fig: Humidity reading and Time line

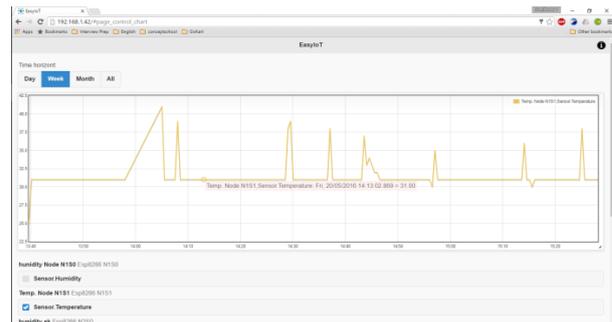


Fig : temperature reading and time line



Fig: EasyIoT GUI

V. CONCLUSION

An automated system is developed to take data from the different sensor nodes. Obtained data can be used to control various actions. A proper database is maintained for data obtained from the sensor nodes.

This data can be accessed by any authorized user from any location. The obtained data can be stored in various format and can be represented in graphical format to increase the readability of data. In this way we can use automation in home, medical care as well as desired industrial selectors. Future work focuses on implanting this concept in all sectors.

REFERENCES

- [1] Mrutyunjaya Sahani, Avinash Nayak, Rishabh Agrawal and Debadutta Sahu, "A GSM, WSN and Embedded Web Server Architecture for Internet Based Kitchen Monitoring System," International Conference on Circuit, Power and Computing Technologies, 2015.
- [2] Ravi M S, "Raspberry PI based Data Sensing and Logging System using Wireless Sensor Nodes (WSN) and Local Area Network (LAN)", International Journal of Engineering Research & Technology (IJERT) Vol. 4 Issue 05, May-2015
- [3] Keerthi VallapReddy, Sandeep Sunkari, "A New method of License plate recognition system using Raspberry Pi processor" IJCSJET (International Journal of Computer Science information and Engg Technologies ISSN 2277-4408
- [4] Fabio Leccese, "Marco Cagnetti and Daniele Trinca A Smart City Application: A Fully Controlled Street Lighting Isle Based on Raspberry-Pi Card, a ZigBee Sensor Network and WiMAX Sensors" 2014
- [5] Ouz Gora, "A Novel Video/Photo Recorder Using an Online Motion Sensor- Triggered Embedded System Innovative Systems Design and Engineering", iiste ISSN 2222-1727
- [6] V. Ramanath "Implementation of Improved Face Recognition Technique for Car Ignition Access Control Using Raspberry Pi", Micro-controller International Journal of Emerging Science and Engineering Volume-3 Issue-9, July 2015
- [7] Cheah Wai Zhao et.al. "Exploring IOT Application Using Raspberry Pi" International Journal of Computer Networks and Applications Volume 2, Issue 1, January - February (2015) 40
- [8] WSN based industrial automation using raspberry pi
- [8] Amol A. Dharmapurikar, R.B. Waghmare "RASPBERRY Pi IN AUTOMATION International Journal of Science, Technology & Management" IJSTM Volume No.04, Issue No. 03, March 2015
- [9] Raguvaran. K, "Raspberry PI Based Global Industrial Process Monitoring Through Wireless Communication International Conference on Robotics, Automation, Control and Embedded Systems 18-20 February 2015.
- [10] Mukesh Kumar, Sanjeev Sharma, and Mansav Joshi, Design of Real Time Data Acquisition with Multi Node Embedded Systems, IJCA., vol. 42, no. 11, pp. 6-12, 2012.
- [11] Raspberry Pi Official website. [Online] Available: <http://www.raspberrypi.org/>
- [12] Raspbian Operating System. [Online] Available: <http://www.raspbian.org/MAEER's>