Industrial Data Logging System using Raspberry-Pi

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Abstract— Knowledge of temperature, relative humidity, pressure or other parameters during a certain time is needed in scientific, medical and industrial applications. Data logging is most important part for manufacturing industries, Automobile industries, Aerospace designing industries etc. Data logging of each and every second of any machine in an industry is manually not possible. So the data logging system is able to record the real time data of each and every second. Logging means to "record the data" from various Industrial sensors and machines to collect the Physical environmental parameters. One of the primary objective of industrial data logging system is to create an ability to automatically collect data on 24- Hours basis without using manual work. A data logger is an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. It combines analog and digital measurements with programming methodology to sense temperature, relative humidity, pressure and other parameters. The aim of this project has been to design a system which would be able to manage the real time data in industry. This real time data also transfer in pen drive and get secure in the form of hardcopy and this data is also use for analysis of previous product.

Key words: Data logger, Sensor, Aerospace Industry

I. INTRODUCTION

A data logger is an electronic instrument that records measurements of temperature, relative humidity, light intensity, voltage, pressure, on/off and open/closed state changes etc. over time. Typically, data loggers are small, battery-powered devices that are equipped with a microprocessor, memory for data storage and sensors. Most data loggers interface with a PC and utilize software to activate the logger and view/analyze the collected data. Data-logging implies data collection with storage for later data processing. A data-logging system has three main components: an interface to link to a computer, sensors and software.

Data loggers are typically compact, battery-powered device equipped with an internal microprocessor, data store and one or more sensors. They can be deployed indoors, outdoors, and underwater, and can record data for up to months at a time, unattended. The sensors may be either analogue or digital. If they take analogue readings, an Analogue to Digital Converter (ADC) will be needed to convert the signal into digital data which the computer can understand.

A data logger may be a single-unit, stand-alone device with internal sensors, which fits in the palm of a hand, or it may be a multi-channel data collection instrument.

II. CIRCUIT DIAGRAM

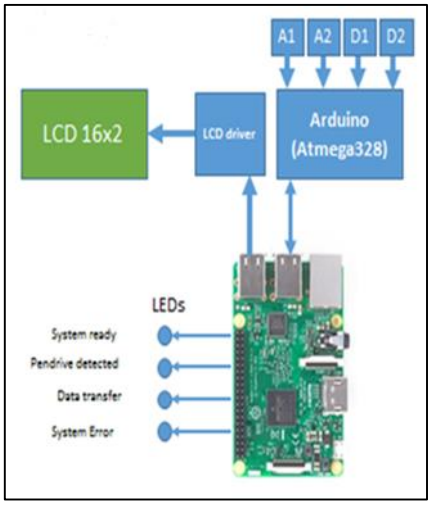

Fig. 1:

III. MATERIAL AND COMPONENTS

A. *Raspberry Pi 3*

Raspberry pi is a series of credit card size computers.

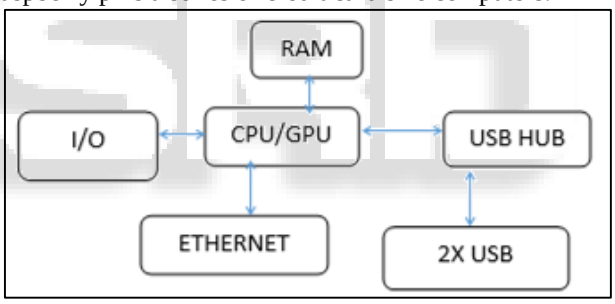

Fig. 2:

The Raspberry pi is 40 pin GPIO. It is 64 bit processor. It acts as a mini computer. The raspberry pi may be operated with any generic USB computer keyboard and mouse. The raspberry pi3 uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 catch. It is a multitasking on chip peripheral. It has 128mb GPU. It contains display jack, Camera slot, Ethernet, USB port, 3.5mm audio jack, in-built Bluetooth and WiFi. Uses LINUX operating system, one wire protocol.

B. *Controller Atmega 328:*

The Atmega328 Is A Single Chip Microcontroller Created By Atmel In The Mega avr Family. The Atmel Avr Risc- Based Microcontroller Combines 32kb Isp Flash Memory With Read While Write Capabilities. It Has S-ram Of 2kb, Eeprom Of 1kb, 23 General Purpose I/O Lines, 32 General Purpose Working Registers , Three Flexible Timer/Counter With Compare Modes, Internal And External Interrupts, Serial Programmable Usart, Spi Serial Port, 10 Bit A/D Converter. Its Maximum Operating Frequency Is 20mhz. The Device Operates Between 1.8-5.5v.

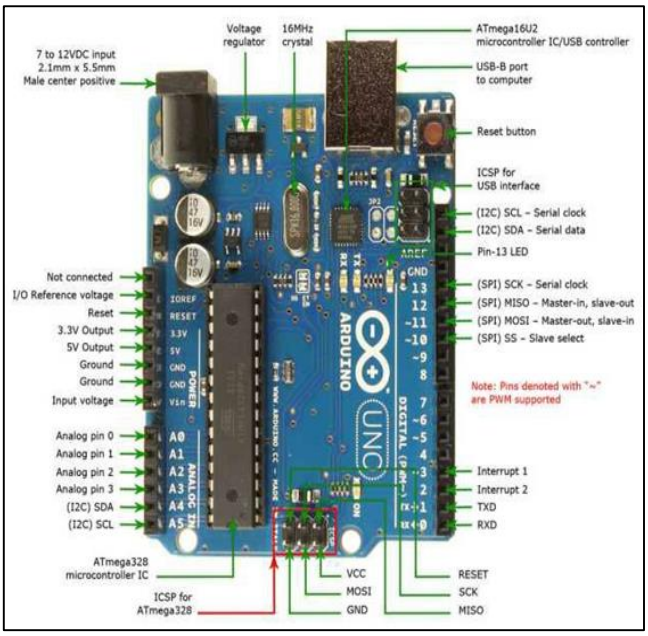

Fig. 3:

C. *Real Time Clock:*

A real time clock is a computer clock that keeps track of the current time. RTCs are present in almost any electronic device which needs to keep accurate time.

D. *Python:*

Python is interpreter. It is used for high data analysis. It uses very small memory. It can be used as a scripting language or can be compiled to byte code for building large applications. It provides very high level dynamic data types and supports dynamic type checking. It supports automatic garbage collection. It can be easily integrated with C, C++ and JAVA, uses less references.

IV. MASTER SLAVE

Master/Slave is a model of communication where one drive has unidirectional control over one or more other devices. In some systems a master is selected from a group of eligible devices, with the other devices acting in the role of slave. In this project serial communication takes place between master and slave.

A. *Serial communication:*

Serial communication is the process of sending data 1 bit at a time, sequentially, over a communication channel or computer bus. It is used for long haul communication and most computer network. Many serial communication system were originally design to transfer data over relatively large distances through some sort of data cable. The term "serial" most often refers to the RS232 port on the back of the original IBM PC. A serial connection requires fewer interconnecting cables and hence occupies less space. Cross talk is less often issue because there are fewer conductors in proximity.

V. WORKING PRINCIPLE

A. *Logging.py*

Logging.py initializes the hardware configuration. Logging.py is designed to acquire data from Universal asynchronous receiver transmitters. This includes sensor communication with arduino and arduino communication with the Raspberry-Pi. To acquire the data from slave device, master device initializes and configure the slave com resources. After the data acquisition from all the sensors, master stores the data to sensor data files and simultaneously stores the data to datalog.csv file for data analysis. This data-logging system is made to run for 24hrs with continuous data storage and to work standalone.

B. *Data Transfer:*

The important feature of data logging system is Pendrive data transfer. Operator can use this feature to collect all the system data for quality analysis and condition monitoring. It also provides a mechanism to update the system software with one button data transfer feature. To update the system software simply connect a pendrive to the USB port and press a button. It takes very less time to update the software and also to calibrate the sensors connected to the system. This mechanism helps to interact with the system even for non technical operator. The Logs are stored in the form of Excel Sheets which can be used to digitize the manual logging in the industries and to minimize the faults.The software is also secured with Licensing. The software uses a unique key to run only on dedicated system and hence it's secured and not possible to hack.

C. *HMI Display:*

The Data-logging System consist of HMI which display the real time data from Sensors connected to the system. Operator can monitor the system performance and also it's easy for an operator to change the settings of the system. The Data-logging system uses an industry standard HMI to provide an easy way to interact with the system.

D. *Thingspeak:*

The data-logger system is a true Internet of Things system. All the connected sensors data is uploaded to database to access it from anywhere. This helps to maintain the system performance, quality analysis, Security to the critical data in Industries. This also helps to update the system software, Remote troubleshooting, Monitoring of the entire sensor network. This data-logger system uses standard protocols specifically made for IOT device to transfer the data wirelessly with more security. It uses protocols like FTP to access the system logs, files related to analysis and software update. This data-logging system runs on 5V power supply. It's an efficient system which runs on low power with greater accuracy.

E. *Firebase Console:*

Google API in which API stands for Application Program Interface. The API reference documentation provides detailed information for each of the classes and methods in the firebase SDK. Firebase's initial product was a real time data base, which provides an API that allows developers to store and sync data across multiple clients. The service provides application developers an API that allows application data to be synchronized across clients and stored on Firebases's cloud. We can represent the data online using firebase console. JSON data is provided by the sensors and the switches and transfers it through the dictionary.

F. APPLICATIONS:

- In Automation industries.
- In Aerospace Industries Data Logger is important.
- Refrigeration and Freezer (including Food & Medical Storage and Transportation).
- Ex: With both food and medicine, it is increasingly important for manufacturers, suppliers and end users to have verifiable evidence that correct environmental conditions have been provided from the moment of manufacture to the time that the goods are used.
- Agriculture, Horticulture, Environmental Studies.
- Server Room Monitoring.
- Ex: The various servers, hard-disks and routers located in the server room form the heart of a modern company - when the network is down, your business is down. The Data Logger is designed to provide you with an early warning should temperatures in your server room start to rise too high.

VI. RESULT

Fig. 4: image showing Temperature & Noise

The above fig shows the data logged by the temperature sensor and sound intensity sensor. The system consists of five Led's and one button. The first Led depicts that the system is ready. The second Led shows the penrive status. The third Led shows that the data is transferring. The fourth Led shows the data uploading process. The fifth Led depicts about the error in the system.

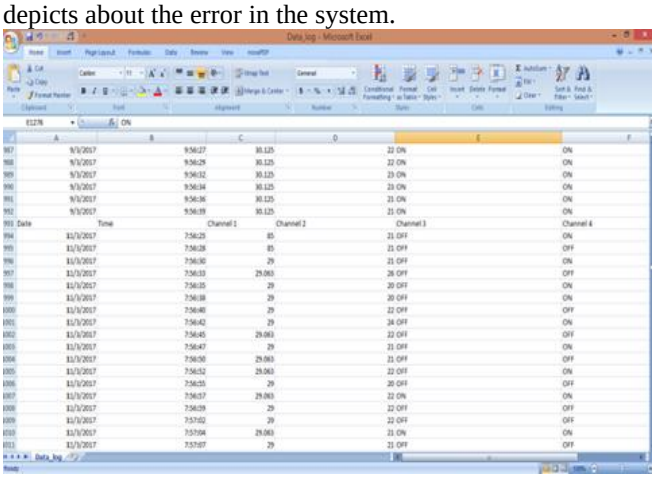

Fig. 5: image showing .csv file

The above fig shows the comma separated value of the logged data i.e. the excel sheet.

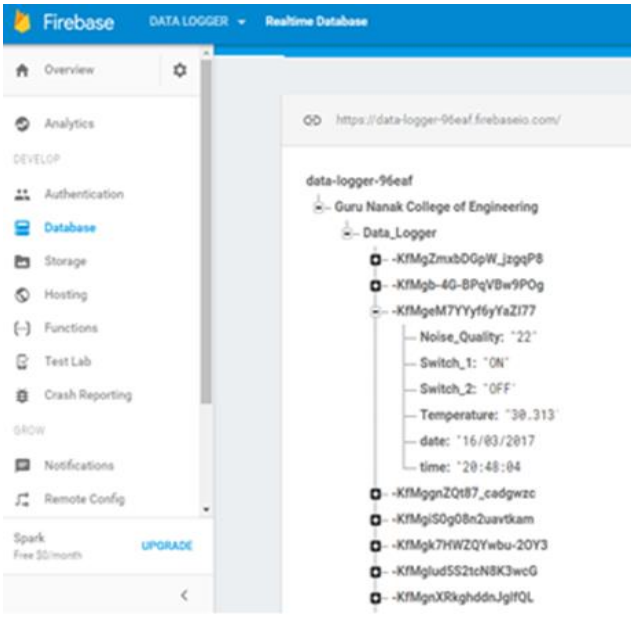

Fig. 6: Image Showing Firebase Console

The above fig shows the API reference documentation provides detailed information for each of the classes and methods in the firebase SDK.

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