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Datalogger System

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ABSTRACT

A "data logger" is a device which takes the readings of specified parameters and when connected to an external display, shows the log of the data whenever required. This project is about a data logger which measures three physical quantities namely "Temperature, Humidity and Pressure". In general, data loggers are used at weather forecasting stations, pharmaceutical industries etc. A data logger reduces the human efforts and saves time as well because it is more or less a difficulty for a man to take readings at specific intervals of time.

In this project, an LCD is provided as an in built feature which enables the user to easily get the details of the recorded data at the current time, whereas in general data loggers the required data is recorded in a memory and connected to a display to visualize the log of the recorded readings and has no screen to display the readings at an instant of time. In this project, a windows application is designed which enables the user to get the log of data whenever required. This application is user friendly, provided with the features like selecting a particular physical measurement from the provided options in order to get the log of that specific measurement readings. These features of the data logger are helpful where the readings of the provided three physical measurements are required.

Therefore, this data logger can be called as a multi-data recorder and can be developed for further advancements.

Key words: Temparatures, Relative humidity, data loggers and thermocouple sensors

INTRODUCTION

1.1 INTRODUCTION

Data loggers are used to record data at set intervals over a period of time. This includes data acquisition device such as serial communication system. For a real time data recording system it uses a

computer. Even wireless transmitters are also capable of turning a regular smart phone into a mobile data logger.

The idea of implementing data logger is to store the data and by using this data we can analyze the performance of the system. In this project the physical quantities that are measuring are temperature, humidity and pressure over defined regular intervals of time. All three parameters are sensed by using sensors. The recorded data is stored in the SD card with a time clock reference and it can be retrieved, viewed and evaluated after it has been recorded. In past times many researches and developments were made on data loggers but in this project along with the data logger we have LCD to display the current recording data and windows application which helps the user to select and view the recorded data log. By using data loggers it is easy for evaluation and visualization of measurement data, continuous data recording over long periods etc. It is a modern enclosure with display.

There are many applications of temperature, humidity and pressure loggers. These loggers are used in a wide variety of industries. There are

1. Medical/vaccine storage.

2. Restaurants.

3. Catering.

4. Transportation of goods.

5. Clean rooms storage areas.

6. Computing centres.

7. Exhibition halls.

2.1 INTRODUCTION TO EMBEDDED SYSTEMS

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called "firm ware". The desktop/laptop computer is a general purpose computer. You can use it for a variety of applications such as playing games, *word* processing, accounting, software development and so on. In contrast, the software in the embedded systems is always fixed listed below:

Embedded systems do a very specific task, they cannot be programmed to do different

things. Embedded systems have very limited resources, particularly the memory. Generally, they do not have secondary storage devices such as the CDROM or the floppy disk. Embedded systems have to work against some deadlines. A specific job has to be completed within a specific time.

2.2 MICROCONTROLLERS

An integrated circuit that contains many of the same items that a desktop computer has, such as CPU, memory, etc., but does not include any "human interface" devices like a monitor, keyboard, or mouse. Microcontrollers are designed for machine control applications, rather than human interaction. All controllers of a family contain the same processor core and hence are code-compatible, but they differ in the additional components like the number of timers or the amount of memory. There are numerous microcontrollers on the market today, as you can easily confirm by visiting the web pages of one or two electronics vendors and browsing through their microcontroller stocks. You will find that there are many different controller families like 8051, PIC, HC, ARM to name just a few, and that even within a single controller family you may again have a choice of many different controllers.

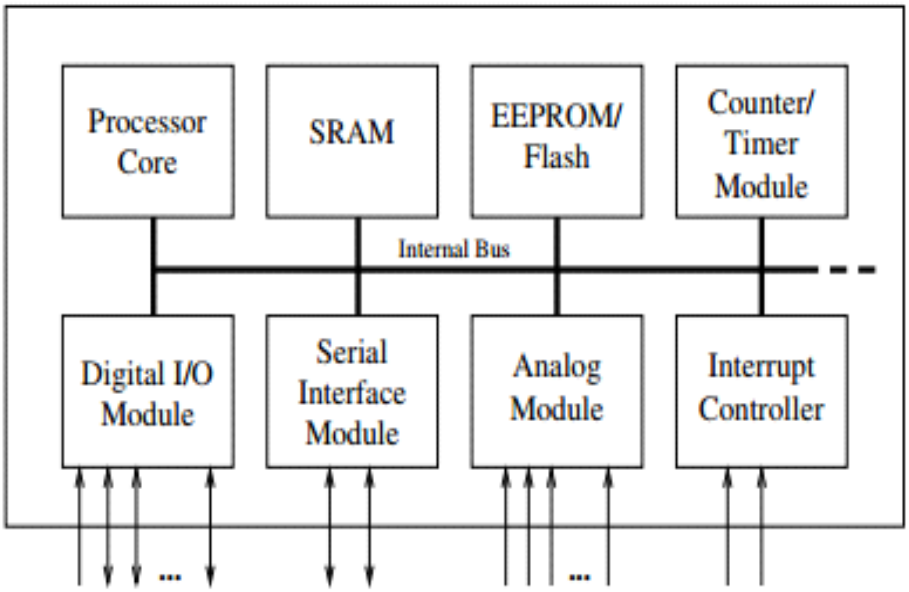


Fig.2.1 Block diagram of a microcontroller

2.4 APPLICATION AREAS

Nearly 99 per cent of the processors manufactured end up in embedded systems. The embedded system market is one of the highest growth areas as these systems are used in very market segment- consumer electronics, office automation, industrial automation, biomedical engineering, wireless communication, data communication, telecommunications, transportation, military and so on.

Consumer appliances:

At home we use a number of embedded systems which include digital camera, digital diary, DVD player, electronic toys, microwave oven, remote controls for TV and air-conditioner, VCO player, video game consoles, video recorders etc. Today's high-tech car has about 20 embedded systems for transmission control, engine spark control, air-conditioning, navigation etc. Even wristwatches are now becoming embedded systems. The palmtops are powerful embedded systems using which we can carry out many general-purpose tasks such as playing games and word processing.

Industrial automation:

Today a lot of industries use embedded systems for process control. These include pharmaceutical, cement, sugar, oil exploration, nuclear energy, electricity generation and transmission. The embedded systems for industrial use are designed to carry out specific tasks such as monitoring the temperature, pressure, humidity, voltage, current etc., and then take appropriate action based on the monitored levels to control other devices or to send information to a centralized monitoring station. In hazardous industrial environment, where human presence has to be avoided, robots are used, which are programmed to do specific jobs. The robots are now becoming very powerful and carry out many interesting and complicated tasks such as hardware assembly.

Medical electronics:

Almost every medical equipment in the hospital is an embedded system. These equipments include diagnostic aids such as ECG, EEG, blood pressure measuring devices, X-ray scanners; equipment used in blood analysis, radiation, colonoscopy, endoscopy etc. Developments in medical electronics have paved way for more accurate diagnosis of diseases.

Computer networking:

Computer networking products such as bridges, routers, Integrated Services Digital Networks (ISDN), Asynchronous Transfer Mode (ATM), X.25 and frame relay switches are embedded systems which implement the necessary data communication protocols. For example, a router interconnects two networks. The two networks

may be running different protocol stacks. The router's function is to obtain the data packets from incoming pores, analyze the packets and send them towards the destination after doing necessary protocol conversion. Most networking equipments, other than the end systems (desktop computers) we use to access the networks, are embedded systems

Telecommunications:

In the field of telecommunications, the embedded systems can be categorized as subscriber terminals and network equipment. The subscriber terminals such as key telephones, ISDN phones, terminal adapters, web cameras are embedded systems. The network equipment includes multiplexers, multiple access systems, Packet Assemblers Dissemblers (PADs), sate11ite modems etc. IP phone, IP gateway, IP gatekeeper etc. are the latest embedded systems that provide very low-cost voice communication over the Internet.

Wireless technologies:

Advances in mobile communications are paving way for many interesting applications using embedded systems. The mobile phone is one of the marvels of the last decade of the 20'h century. It is a very powerful embedded system that provides voice communication while we are on the move. The Personal Digital Assistants and the palmtops can now be used to access multimedia services over the Internet. Mobile communication infrastructure such as base station controllers, mobile switching centres are also powerful embedded systems.

Insemination:

Testing and measurement are the fundamental requirements in all scientific and engineering activities. The measuring equipment we use in laboratories to measure parameters such as weight, temperature, pressure, humidity, voltage, current etc. are all embedded systems. Test equipment such as oscilloscope, spectrum analyzer, logic analyzer, protocol analyzer, radio communication test set etc. are embedded systems built around powerful processors. Thank to miniaturization, the test and measuring equipment are now becoming portable facilitating easy testing and measurement in the field by field-personnel.

Security:

Security of persons and information has always been a major issue. We need to protect our homes and offices; and also the information we transmit and store. Developing embedded systems for security applications is one of the most lucrative businesses nowadays. Security devices at homes, offices, airports etc. for authentication and verification are embedded systems. Encryption devices are nearly 99 per cent of the processors that are manufactured end

up in~ embedded systems. Embedded systems find applications in . every industrial segment- consumer electronics, transportation, avionics, biomedical engineering, manufacturing, process control and industrial automation, data communication, telecommunication, defense, security etc. Used to encrypt the data/voice being transmitted on communication links such as telephone lines. Biometric systems using fingerprint and face recognition are now being extensively used for user authentication in banking applications as well as for access control in high security buildings.

Finance:

Financial dealing through cash and cheques are now slowly paving way for transactions using smart cards and ATM (Automatic Teller Machine, also expanded as Any Time Money) machines. Smart card, of the size of a credit card, has a small micro-controller and memory; and it interacts with the smart card reader! ATM machine and acts as an electronic wallet. Smart card technology has the capability of ushering in a cashless society. Well, the list goes on. It is no exaggeration to say that eyes wherever you go, you can see, or at least feel, the work of an embedded system!

3. DATA LOGGER

3.1 INTRODUCTION TO DATA LOGGER

A data logger is an electronic instrument that records measurements at set intervals over a period of time. Depending on the particular data logger, measurements can include: air temperature, relative humidity, AC/DC current and voltage, differential pressure, time-of-use (lights, motors, etc.), light intensity, water temperature, water level, dissolved oxygen, soil moisture, rainfall, wind speed and direction, leaf wetness, pulse signals, room occupancy, plug load, and many more.

Data loggers are typically compact, battery-powered devices equipped with an internal microprocessor, data storage, 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. 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 equipped with one or more external sensors.

3.2 TYPES OF DATA LOGGERS

There are several types of data loggers on the market today. Most fall under one of the following three categories: mechanical, electronic, or wireless and RFID. However, these categories can be slightly confusing or misleading, because many of them have similar features. For example, all three types are electronic devices. Additionally, data loggers can also be categorized by what they measure: temperature, humidity, shock, etc.

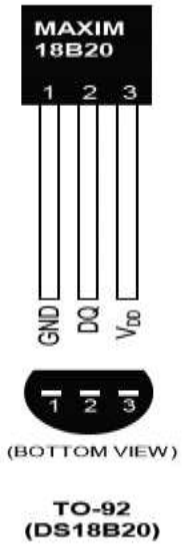
3.2.1MECHANICAL DATA LOGGERS

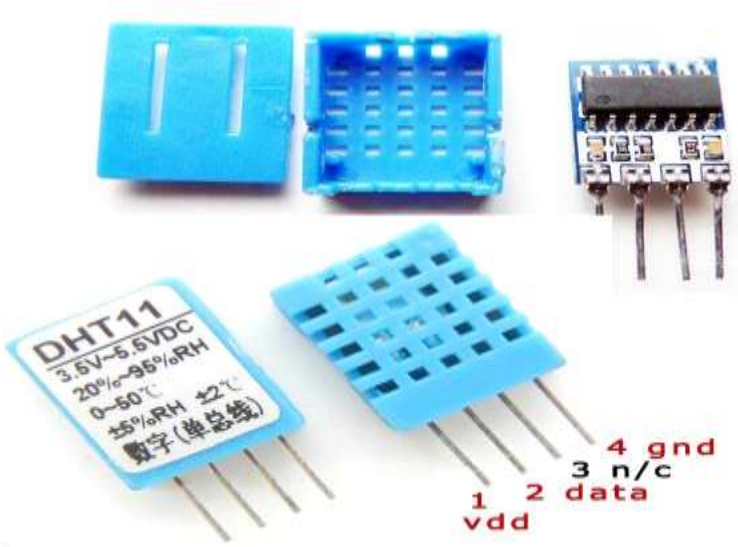
Mechanical data loggers are true stand-alone devices, meaning that you do not need a computer to operate them. Plus, the data they collect is printed directly onto paper, in the form of a strip chart, enclosed within the data logger itself. Mechanical loggers are easily started by pulling a tab and, when you are ready to review the collected data, you simply remove the strip chart.

3.2.2 ELECTRONIC DATA LOGGERS

Electronic data loggers, require you to use a PC. By using a computer, you can do more with an electronic data logger than you can with a mechanical logger. Electronic data loggers are programmable. For example, you can choose the interval readings, meaning it will record the conditions you want to monitor every "x" number of minutes or seconds. Also, with the help of special software, you can download the recorded data onto your PC. You can organize and analyze your data and decide how you want it reported

3.2.3 DHT 11-HUMIDITY AND TEMPERATURE SENSOR





3.2.3 DESCRIPTION

The DHT11 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response,

anti-interference ability and cost-effectiveness.

Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package.

DHT11's power supply is 3-5.5V DC. When power is supplied to the sensor, do not send any Instruction to the sensor in within one second in order to pass the unstable status. One capacitor

valued 100nF can be added between VDD and GND for power filtering.

5. HARDWARE DEVELOPMENT

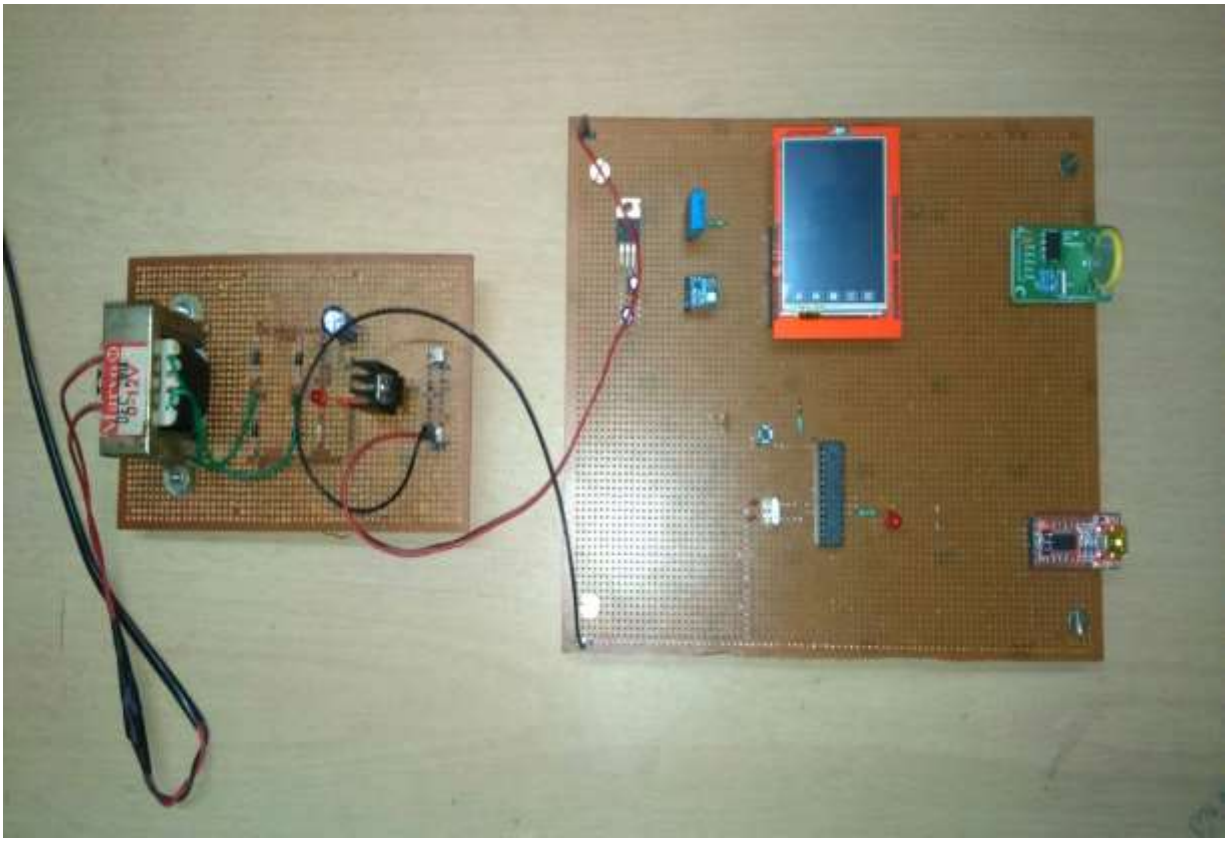
5.1 2.4" TFT LCD DISPLAY (SPFD 5408)

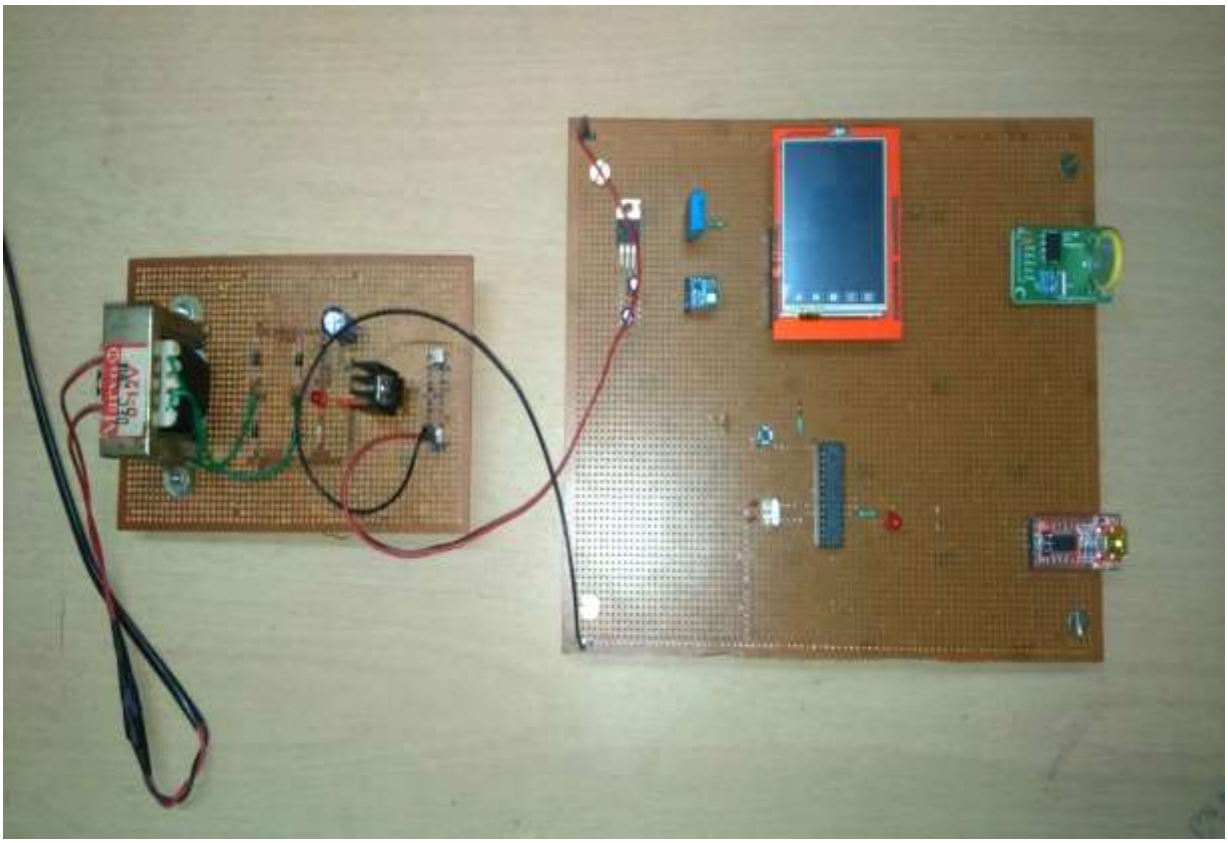
5.1.1 DESCRIPTION

The SPFD5408 is a color System-on-Chip (SoC) driver designed for small and medium sizes of TFT LCD display. The720-channel source driver has true 6-bit resolution, which generates 64 Gamma-corrected values by an internal D/A converter. The SPFD5408A is able to operate with low IO interface power supply up to 1.6V.The built-in timing controller in SPFD5408A can support several interfaces for the diverse request of medium or small size portable display. SPFD5408A provides system interfaces, which include 8-/9-/16-/18-bit parallel interfaces and serial interface (SPI),to configure system. Not only can the built-in power-sense circuit that detects power failures and automatically switches to the

battery supply. The DS1307 supports the I2 C protocol. A device that sends data onto the bus is defined as a transmitter and a device receiving data as a receiver. The device that controls the message is called a master. The devices that are controlled by the master are referred to as slaves. The bus must be controlled by a master device that generates the serial clock (SCL), controls the bus access, and generates the START and STOP conditions. The DS1307 operates as a slave on the I2 C bus.

6. IMPLEMENTATION AND RESULT





6.1. TESTING AND VALIDATION

TESTING AND VALIDATION

Testing of our project consists of evaluating the application (including its components) behaviour, performance and robustness. Expected behaviour, performance and robustness is seen with the microcontroller used in this project.

After the power supply is ON, the sensors used in the project takes the readings of temperature, humidity and pressure of the surroundings at defined intervals of time. These readings are recorded in an **SD card**. The current readings are displayed on the **TFT SPFD 5408 display**. When the module is connected to a computer, the logged data of readings in SD card is displayed on the **windows application**

7. CONCLUSION AND FUTURE SCOPE

CONCLUSION

The project explained here is an excellent one to reduce the human efforts where it is mandatory to know the readings

of specific parameters time to time in places like pharmaceutical industries etc. This project can be called as a multi data recorder as this is able to record the data of multiple parameters. The data logged is displayed on the windows application and hence it can be regarded as an advanced data logger.

This data logger can be used in places like:

- Pharmaceutical industries.
- Weather forecasting stations.

FUTURE SCOPE

This Product can be further modified by using extra number of sensors to take various other readings and we can also add a GSM so that we can get to know the readings of the parameters though we are not present at the required location.

APPLICATIONS

There are a wide range of applications present. It can be used mainly in industries, homes, hospitals etc.

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