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# DESIGN AND DEVELOPMENT OF MULTIPLE LEAD ACID BATTERIES ON REAL TIME MONITORING SYSTEM

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**ABSTRACT:** Battery monitoring could be an important application in many Industrial and residential users. The accuracy of these systems has always been the most focus of dialogue because they often take all the parameters together and make the foremost important error. So, Batteries are the foremost important many Industrial and residential users. Therefore, it is important for the right maintenance of any battery to work properly. Effective monitoring of lead-acid batteries (commonly employed in automotive batteries) should make them effective altogether cases. An accurate battery management system should be implemented to continuously monitor the performance of the battery. As for batteries, the two most important parameters are the battery's ultrasonic sensor and thus the pH sensor. These sensors and data loggers combine to easily record static data. The system is formed from different sensors that record the data required for the recommended locations for intelligent analysis of the environmental conditions.

**KEYWORDS:** Lead-acid batteries, Humidity and temperature sensors.

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## I. INTRODUCTION

Battery based appliances or battery operated vehicles plays major role at present situation, because of continues growth of population, the required amount of conventional power is huge for home appliances and for industrial purposes. But the generating power is low at the same time due to power failure and other interruptions the continues usage is not possible. Hence we go for battery based appliances and vehicles. Here in the device the energy is stored and the stored energy is utilized for continues operation and also had some advantages like low maintenance cost, Easy transportation and compactable.

Nowadays all expecting to purchase Electric-Vehicles like E-Bike and E-Car for transportation. It is easier for charging and once charging completed, can travel for long distance. At the same time maintenance cost also reduced and the battery is more compact in size. Battery is the heart of the electrical vehicles. Battery maintenance is easier than other sources.

Other than the Electric-Vehicles all vehicles can start only by battery, without battery can't start. Main of the appliances is depending on the battery. For home, industries, substations were hold batteries for backup purpose.

In substations batteries is live 24X7 for continuous monitoring (Relays operate and monitor present situation, when main source is switched OFF) the substation equipment's from failure. In-case any malfunction or abnormal fault occurred relays operated safe guard the substation equipment's with the help of batteries.

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## II. MAIN SCOPE OF THE DESIGN

Reliable battery management is important for safety. There are many reasons for battery breakdown, like battery malfunction and style flaws. A manual battery monitoring system is a normal monitoring system, which it doesn't store data in the database and the performance only can be obtained from the output of the battery. Therefore, it's necessary to remotely monitor the battery system using wireless technology. So many home and industries required uninterrupted power supply (UPS) and the performance can be monitored at real time wireless communication have evolved using Internet of Things (IOT).

The PLC-based Battery Health Monitoring System is suggested to E-Vehicles and UPS using the GSM module, and provides a warning message when the battery is in critical condition. In this modern battery monitoring system the humidity, temperature, water level and specific gravity levels monitored continuously for providing better output efficiency to the load.

## III.OBJECTIVE OF THE DESIGN

- To monitor the humidity level of the batteries,
- To monitor temperature level of the batteries,
- To monitor the water level of the batteries,
- To monitor the specific gravity of the batteries,
- By monitoring above parameters in real time monitoring system better life time of the battery can achieved.
- By monitoring the above parameters efficiency level can be improved.

### A. Literature explanation of the design

Based upon the literature, till now the manual response is the only solution for Battery Monitoring system. Here in the topic, manual battery monitoring system with drawback is explained thoroughly.

In manual battery monitoring system, the performance parameters are received from output terminals and then it is analyzed manually by comparing voltage and current by using voltage and current sensors respectively. Based on the output analysis the performance and the present state of battery can be calculated.

If the level of water decreased or the temperature inside the cell increased or the specific gravity value decreased or the acid formation inside the cell results to damage the battery and it affects the battery performance and life time.

In manual battery monitoring system, continuous monitoring is not possible; it leads to sudden influence in the power output especially in the multiple batteries interconnecting system, sudden variations made the bigger issue. Hence the manual monitoring for more number of batteries is complex. Limited range of values only can be sensed.

So many drawbacks in the manual battery monitoring systems are reviewed and looking for the solution through modern battery monitoring system was designed. In this continuous monitoring system each and every batteries can be monitored separately in real time using Internet of Things.

In modern battery monitoring system, the battery humidity, temperature, water level, specific gravity value and the charging and discharging states can be monitored continuously.

In case any variations with margin values, sudden information passed to the administrator to rectify the problem and to avoid the battery damage and to avoid affecting continuous output from the interconnected circuit.

### B. History of the manual battery monitoring system

- Battery performance is influenced by the factors like depth of discharge (DOD), temperature and charging algorithm.
- In the prevailing system of this method, the health monitoring of the batteries are performed by using temperature sensor and voltage sensors.
- So the voltage level and temperature level only be calculated during this technique. Charge condition is additionally obtained from the output of the prevailing system.

### C. Manual battery monitoring system drawbacks

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- Complex modeling requirements.
- Increased operational complexity.
- Less accuracy data from the sensor.
- Limited range of application and monitoring the data can't be read accurately.

**D. Manual battery monitoring system block diagram**

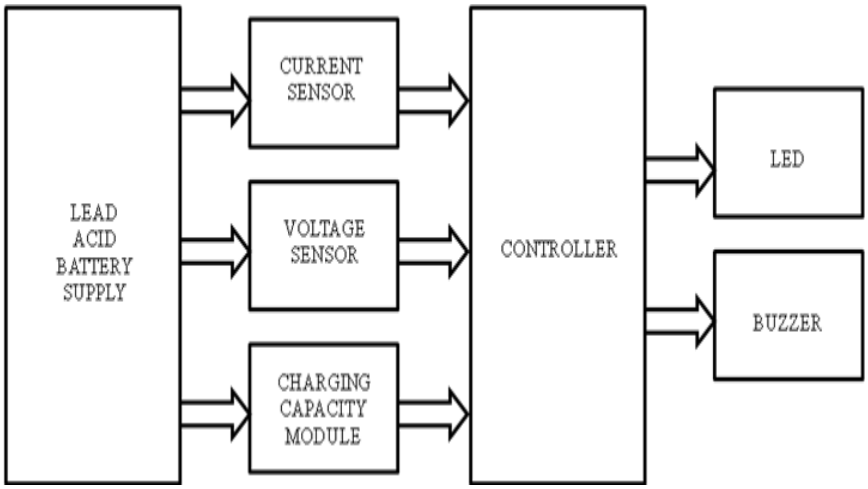


**Figure 1:** Manual Battery Monitoring System Block Diagram

**Design of modern battery monitoring system**

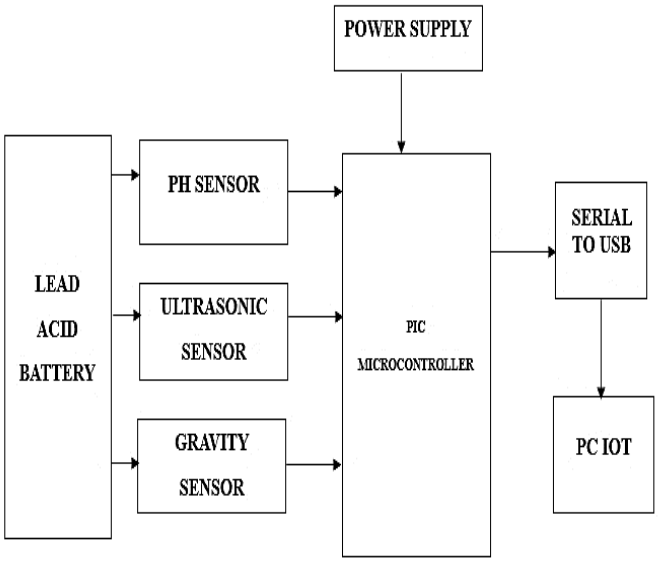


**Figure 2:** Modern Battery Monitoring System Block Diagram

Demand for electrical industry applications is growing rapidly. This is often the facility that several transport vehicles and heavy industry uninterrupted power (UPS) systems use for his or her smooth operation. During this manner, charging and discharge currents are measured and defined. For digitizer, the voltage measurement output will be easily calibrated and controlled. By continuous monitoring the level of water, temperature, humidity, specific gravity value, acid formation inside the cell and charging and discharging state brings the extended battery life, increase performance of the battery and the output efficiency automatically increased. In this modern system no lapse that continuous monitor the each and every batteries were connected. In modern system multi number of Lead- Acid batteries can be easily monitored at a time. Each and every value can be analysed by using

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microcontrollers with the specified values. If anyone of the battery, value varied above or below then the reference value then it may be intimated as "battery gets affected". Hence the specified battery can be isolated from the circuit and it can be easily replaced with respect to the continuous output. Nowadays Electric vehicles can run only with the help of batteries, it must be monitored continuously otherwise the performance of the system may reduce. To avoid such occurrences battery performance can be easily monitored continuously with the help of modern battery monitoring system with real time using IOT. The Internet of Things may be a network of physical objects, vehicles, machines, home appliances and more sensors exchange data over the net. It means fetching all the data's from monitoring system to server within the world and joining them to the internet. Collected details communicated to the administrator through internet. Over internet administrator can change the inputs and outputs values and control the entire circuit.

### A. Ultrasonic sensors

Ultrasonic sensors are accustomed detect obstacles. The ultrasonic sensor sends ultrasonic waves from the sensor's head and receives ultrasonic waves reflecting back from the thing. There are many instructional warning systems, like ultrasonic sensors utilized in many applications, and ultrasonic sensors like automatic door openers are extremely compact and highly efficient.


**Figure 3:** Ultrasonic Sensor Diagram

The electrical spring circuit is employed to compensate the system output voltage in an unbalanced state. A voltage sensor is employed to investigate the source voltage and output voltage and also the analysis data to the controller. If any imbalance occurs on the load side, an electrical spring circuit provides a compensation voltage to be applied to the system. The PIC microcontroller is fast and straightforward. Once we compare other microcontrollers with the identical PIC16F877A implementation. The straightforward to program and straightforward to interact with other peripherals PIC become successful microcontrollers. PIC microcontroller PIC16F877A is most well-known microcontroller. The controller is comfortable to use, and it's simple to program or to code for the controller. One major benefit is to write down or to delete as again and again as possible, because it implements flash technology. It's a complete of 40 pins of input and 33 pins of output.

### B. Lead acid battery surveillance

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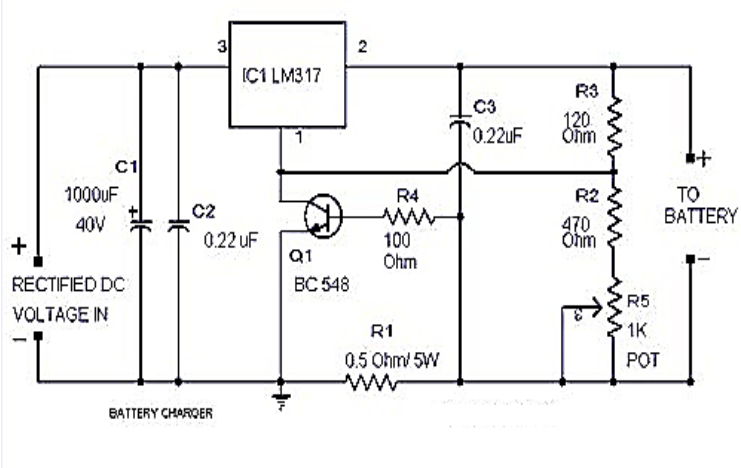


**Figure 4:** Lead Acid Battery Surveillance Diagram

### C. Power supply and internet of things

Most of all power is produced, transmitted and pass around within the sort of AC for economic principles, operation of maximum device circuits, an on the spot Current power supply is needful. Batteries used for the aim of supplying DC.

There's little doubt that they need the advantage of being small and not ripple, but the voltage is low, they have to be change again and again, and that they are costly compared to standard DC power lines. At this time all electronic circuits have convertor to convert AC power into DC power.

AC input power is injected to transformer and also the output supplied by the transformer older a transformer (Diode circuit) and to the filter DC source are delivered to the connected load.

The net of Things may be a network of physical objects, vehicles, machines, home appliances and more sensors and APIs to attach and exchange data over the net. The net of Things in-fact a fairly simple concept, it means fetching all the items within the world and joining them to the net.

## IV. HARDWARE MODULE OF MODERN BATTERY MONITORING SYSTEM

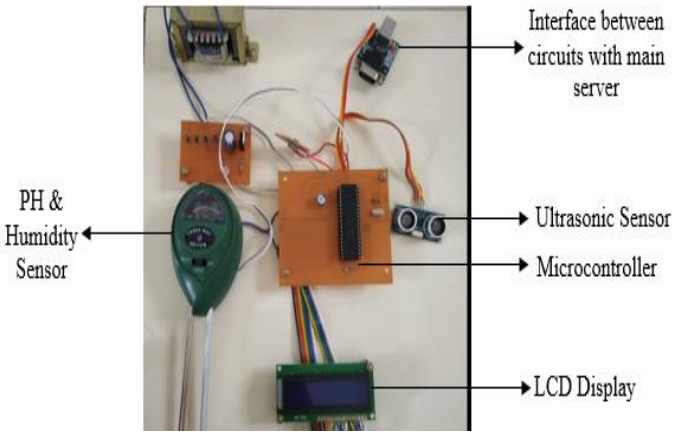


**Figure 1:** Hardware Module of Modern Battery Monitoring System

**Table 1:** Specification of the Design

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| S. No. | Hardware | Purpose / Specification | Input Ranges | Output Ranges |
|---|---|---|---|---|
| 1 | Battery | Input power | 12V | 7.2A |
| 2 | Microcontroller | PIC(16F877A) | 5V DC | 5V DC |
| 3 | Relay | Output power | 12V | 12V |
| 4 | Ultrasonic sensor | Input power | 5V | 5V |
| 5 | PH sensor | Output power | 5V | 5V |
| 6 | Temperature Sensor | Temperature | 5°C to 45°C | 5°C to 45°C |
| 7 | Humidity Sensor | Moisture | 0 to 50grams | 0 to 50grams |
| 8 | Water Level sensor | Water | Minimum safe level | Maximum safe level |
| 9 | Voltage Sensor | Voltage | 12V | 24V |

**Modern Battery Monitoring System output**

| | Battery_Id | Temperature | Humidity | Level_Sensor | Capacity | Full_Capacity | Voltage | State_of_Charge | Average_Current |
|---|---|---|---|---|---|---|---|---|---|
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## V. RESULT AND DISCUSSION

**Case -01: If the temperature value increases**

1. Heat is the worst enemy of batteries, including lead acid. Adding temperature compensation on a lead acid charger to adjust for temperature variations is said to prolong battery life by up to 15 percent. The recommended compensation is a 3mV drop per cell for every degree Celsius rise in temperature.

2. The capacities of lead-acid batteries are very dependent on the temperature at which the battery is operating. The Capacity is normally quoted for a temperature of 25°C however; the capacity will reduce by about 50% at -25°C and will increase to about 10% at 45°C.
3. Absorption Charge – The voltage remains constant, typically about 14.2V for a 12V system (depending on temperature) and the current tapers off as the battery reaches 100% charge.
4. Trickle or Float Charge – For a 12V battery bank a voltage of about of about 12.8 to 13.2V is maintained across the batteries to keep them in good condition (depending on temperature).
5. Watch cell temperature, as excessive heat will damage lead-acid cells. Acid temperature should not exceed 36°C

**Case – 02: If the humidity value increases**

1. The ideal storage humidity is 50%, some sealed lead acid batteries have terminals which will start to rust in very humid conditions.
2. Surface rust can quickly be cleaned away with sandpaper or baking soda mixed with water but if there is serious corrosion this will create an uneven surface on the terminal which could cause connection issues when attempting to use the battery.
3. Stored lead acid batteries create no heat. High ambient temperatures will shorten the storage life of all lead acid batteries. Vented lead acid batteries would normally be stored with protecting plugs installed, in which case they release no gas. With protecting plugs removed, vented lead acid batteries can give off minor amounts of hydrogen and oxygen due to normal evaporation of water, depending upon the amount of ambient heat and air humidity.
4. If you are in an area with high humidity and the terminals are from a metal that will rust then smear them with grease to provide a water proof layer.

**Case – 03: Discussion**

1. Modern battery monitoring system information transferred through internet of things to server to analyse the present performance of the battery.
2. Fully automotive, compact for transport vehicle.
3. The detector analyzes the value and gives the accurate value of connected batteries.
4. They are simple to obtain, comparatively low priced and supply a way power to whatever they're attached to.
5. By Real Time Monitoring of lead acid batteries continuously, life and output efficiency are enhanced.

## VI. CONCLUSION

It is ascertained that multiple number of batteries can be monitored continuously on real time by remotely and each and every information may be exchanged to remote server periodically over the web. It observed that the IOT feature contributes greatly to the systems remote monitoring and control. It's significant that remote of charging and discharging operations allows the system to modify on and off in certain situations. Finally by continuous monitoring of multiple lead-acid batteries on real time using IOT is a easiest one and uneducated person also easily came to know the present position of the battery which is connected to the server.

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