INTRODUCTION

- Modern vehicles need continuous monitoring of internal and external parameters to ensure safety, performance, and comfort. Important factors include engine temperature, fuel level, vehicle speed, and surrounding conditions.
- A Data Acquisition System (DAS) provides real-time monitoring, allowing quick detection of problems and corrective action.
- For example, temperature monitoring prevents engine overheating, while light sensing enables automatic headlight operation.
- Real-time data collection is vital in safety-critical systems where even small delays can cause serious issues.
- Vehicle manufacturers and researchers also use DAS during testing to improve design, fuel efficiency, and reliability.

WHY THIS PROJECT IS IMPORTANT?

- Ensures vehicle safety by continuously monitoring critical parameters like temperature, speed, fuel, light.
- Provides real-time data, allowing quick detection of faults and immediate corrective action.
- Helps prevent accidents and breakdowns.
  (e.g., overheating, low visibility)
- Improves vehicle performance, efficiency, and reliability.
- Supports manufacturers and researchers in testing and design improvements.

PROBLEM STATEMENT

- Modern vehicles require continuous monitoring of multiple parameters such as temperature, light intensity, and variable control inputs to ensure safety, efficiency, and performance.
- Therefore, there is a need for a low-cost, reliable, and integrated Data Acquisition System (DAS) that can collect data from multiple sensors, digitize it accurately, timestamp it, and provide real-time updates for effective vehicle monitoring.

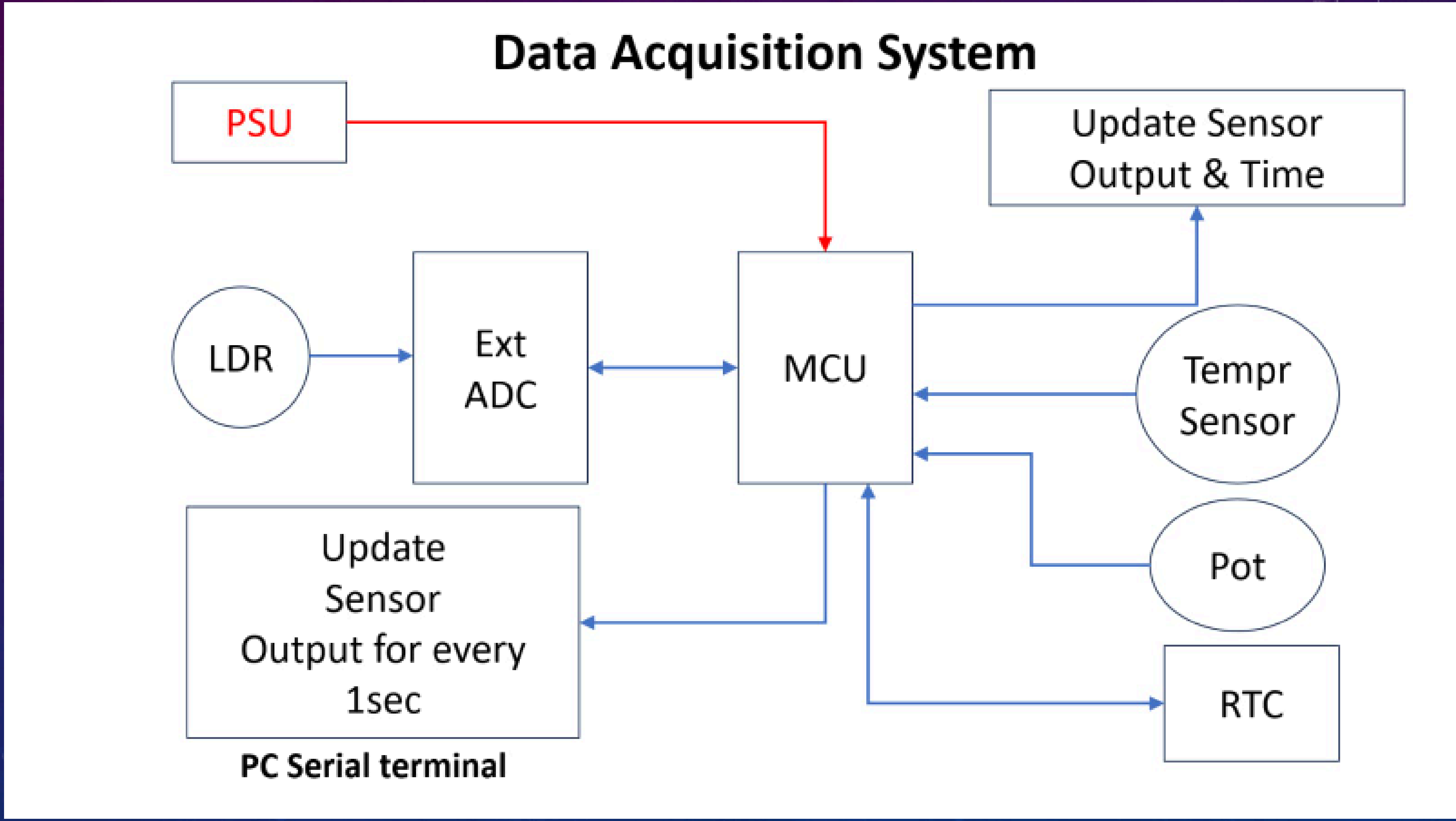
OBJECTIVES

- To develop an integrated system for vehicle parameter monitoring.
- To acquire data from multiple sensors (LDR, Temperature, Potentiometer, RTC).
- To use ADC and MCU for processing and accurate data handling.
- To display real-time sensor values on the PC terminal at regular intervals.
- To provide a reliable and low-cost solution for vehicle safety and performance analysis.

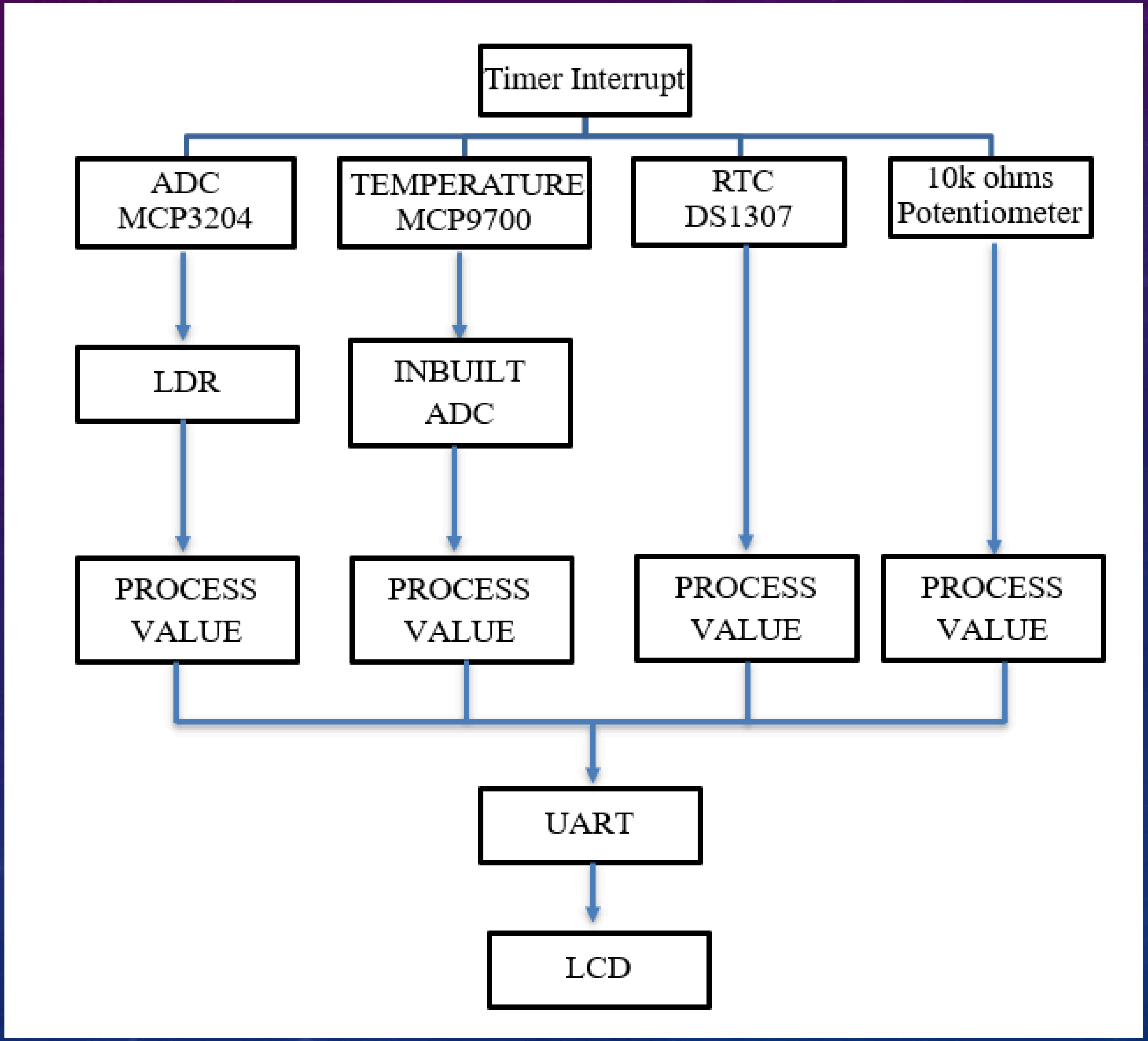
LITERATURE SURVEY

- **Liu et al.** [1] presented an Electric Vehicle Real-Time Condition Monitoring System using IoT technology. The system employs a PIC microcontroller, GPS, GSM communication, and a 3-axis accelerometer to track vehicle condition and location. Sensor data is transmitted in real-time to remote servers, allowing for remote diagnostics and theft prevention. While effective for remote tracking, this system is complex, expensive, and relies on continuous internet connectivity making it unsuitable for simple, localized DAS implementations focused on real-time sensor logging within vehicles.
- **Kanak Chandra Sarma et al. (2012)** [2] built a low-cost PC-based real-time temperature and humidity monitoring system using a PIC12F675 microcontroller. This system offered four analog input channels, 10-bit resolution, and serial output to a PC for graphical and numerical display. While cost-effective and accessible, it did not include timestamping (RTC) or support for multiple simultaneous sensors relevant to vehicular contexts (e.g., LDR, multiple analog inputs), nor was it tailored for vehicle deployment.

BLOCK DIAGRAM



FLOWCHART



Timer Interrupt
ADC MCP3204
TEMPERATURE MCP9700
RTC DS1307
10k ohms Potentiometer
LDR
INBUILT ADC
PROCESS VALUE
PROCESS VALUE
PROCESS VALUE
PROCESS VALUE
UART
LCD

HARDWARE COMPONENTS USED

- LPC2129 Microcontroller
- MPC9700 Temperature Sensor
- Potentiometer
- LDR with MCP3204 (via SPI)
- RTC DS1307 (via I2C)
- 16x2 LCD Display

SOFTWARE USED

- Keil µVision IDE
- Flash Magic
- Embedded C Language

IMPLEMENTATION

1. **Power ON & Initialization** – MCU sets up GPIO, LCD, I2C, SPI, and ADC.
2. **RTC Setup (DS1307)** – Reads real-time clock data (time & date) via I2C.
3. **Light Sensing** – LDR connected via MCP3204 ADC (SPI) gives digital light intensity.
4. **Temperature Sensing** – MPC9700 sensor gives analog value → converted to °C using ADC.
5. **Potentiometer Input** – ADC reads variable voltage (e.g., throttle/speed control).
6. **Timer Interrupt** – Ensures sensor readings & updates happen every second.
7. **Data Processing** – Raw values converted into meaningful units (°C, %, voltage).
8. **Timestamping** – Sensor data combined with RTC time for accuracy.
9. **LCD Display** – Shows temperature, light, potentiometer value, and time.
10. **Continuous Monitoring** – System keeps updating in real-time.
11. **System Loop** – Process repeats endlessly for uninterrupted monitoring.

RESULT OBTAINED

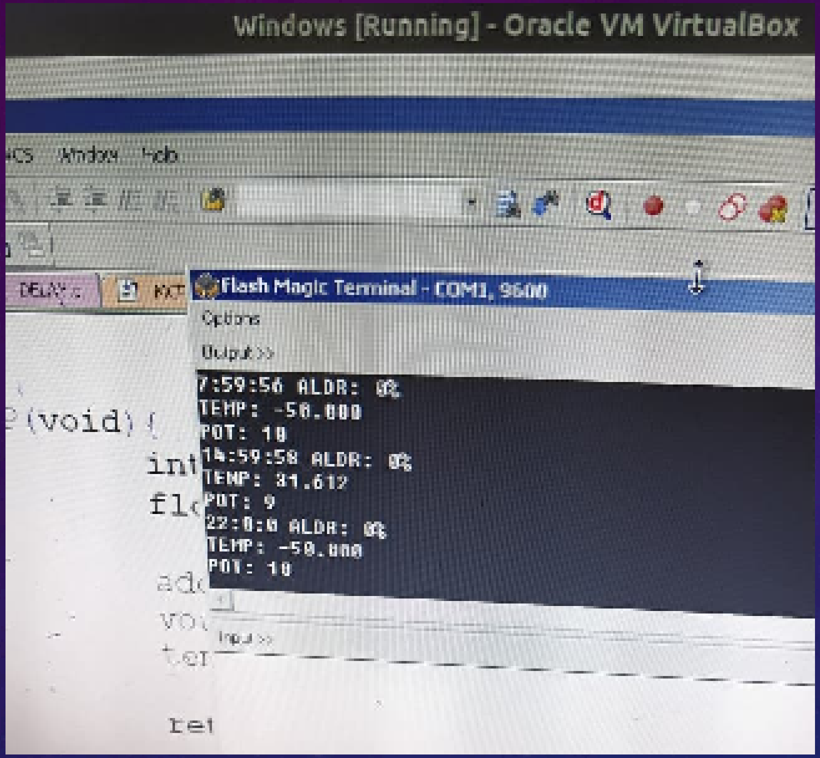


Figure 1: Output of sensor values on Flash Magic Terminal through UART communication

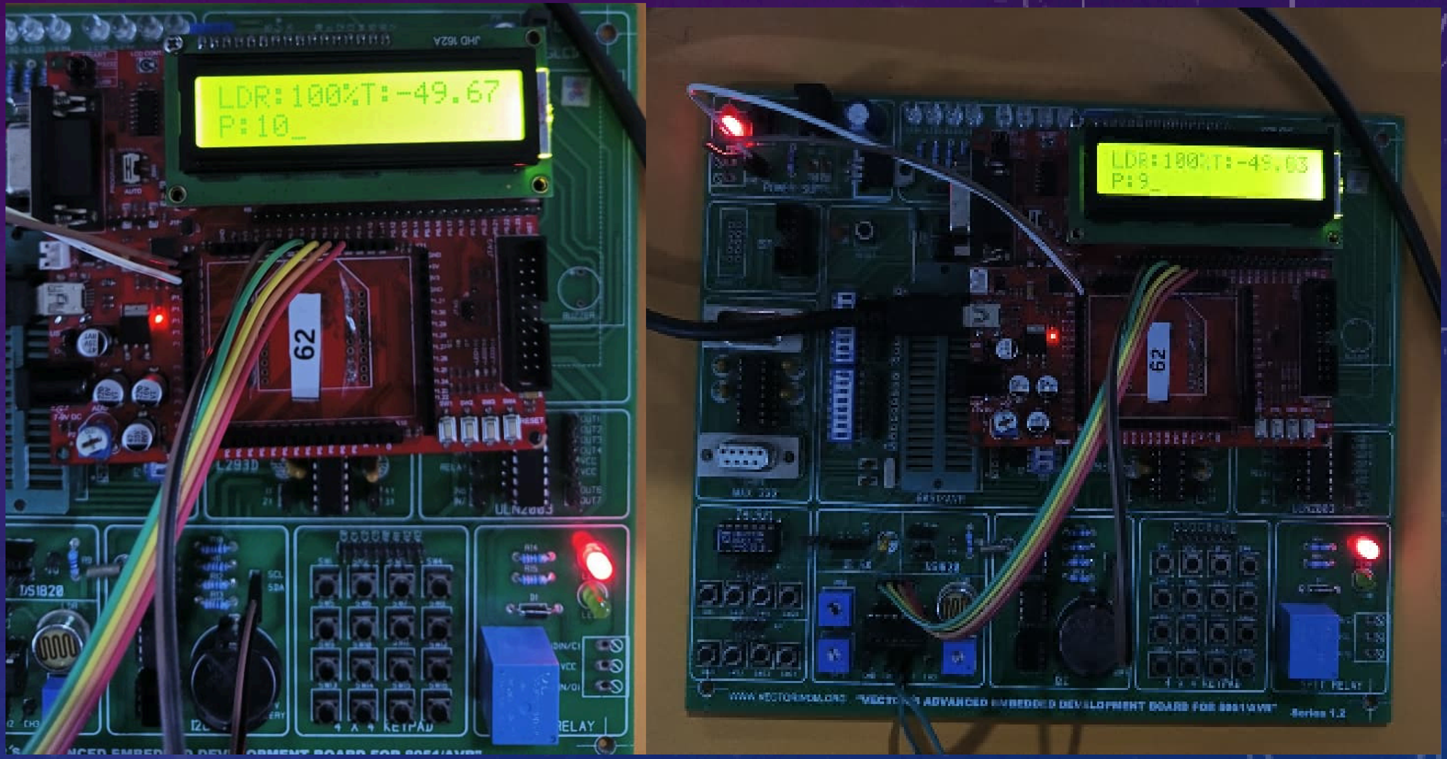


Figure 2: Real-time sensor output (LDR, Temperature, Potentiometer) displayed on LCD.

CONCLUSION

- In this project, a data acquisition system was successfully implemented using the LPC2129 microcontroller.
- Different sensors such as LM35 for temperature, LDR with MCP3204 through SPI for light intensity, and a potentiometer through ADC were integrated and monitored in real-time.
- The RTC DS1307, interfaced via I2C, provided accurate time-stamped data.
- A timer interrupt ensured that sensor readings were updated periodically without delay, and the results were clearly displayed on an LCD module.
- This shows that the system is capable of continuously collecting, processing, and displaying multiple sensor values in real time with efficient use of communication protocols like SPI, I2C, and ADC.

FUTURE SCOPE

- **Expandability** – Add more sensors (humidity, gas, motion) and upgrade to graphical LCD/touchscreen for better usability.
- **Connectivity** – Store data on SD card or transmit wirelessly (Bluetooth, Wi-Fi, GSM) for remote monitoring.
- **Smart Features** – Use machine learning for predictive analysis
- and evolve into a complete IoT-based smart monitoring system.

THANK YOU!!