GANESH COLLEGE OF ENGINEERING

Mettupatti, Salem – 636111

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

NEXT-GEN RAILWAY TRACK MONITORING AND CONTROLLED BY IOT

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PROJECT GUIDE
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AP/ECE

OBJECTIVE

- Using multiple sensors to identify the problems in **Railway Tracks.**
- After that using IOT(Internet Of Things) platform to store the detected **Values** or **Problems** and display into the **Railway station control room.**
- The main objective of this project is provide the multi sensor railway track geometry surveying system.
- Detecting these problems early can prevent accidents and derailments, ensuring the well-being of passengers and crew.

ABSTRACT

- An IoT-based railway track system is to identify the crack and object detection system is an innovative solution for ensuring the safety and security of railway systems.
- The system uses a combination of sensors that are installed along the railway track to monitor it for any symptoms of damage or obstructions.
- The sensors can detect vibrations and changes in the track, which can indicate the presence of a crack or other type of damage.
- Once the system detects an issue, it will be send to the IOT server and alert to nearest station.

EXISTING SYSTEM

- It Surveying manually.
- It can be operated in tunnels with interruption (Crossing human beings, Animals and object in the track).

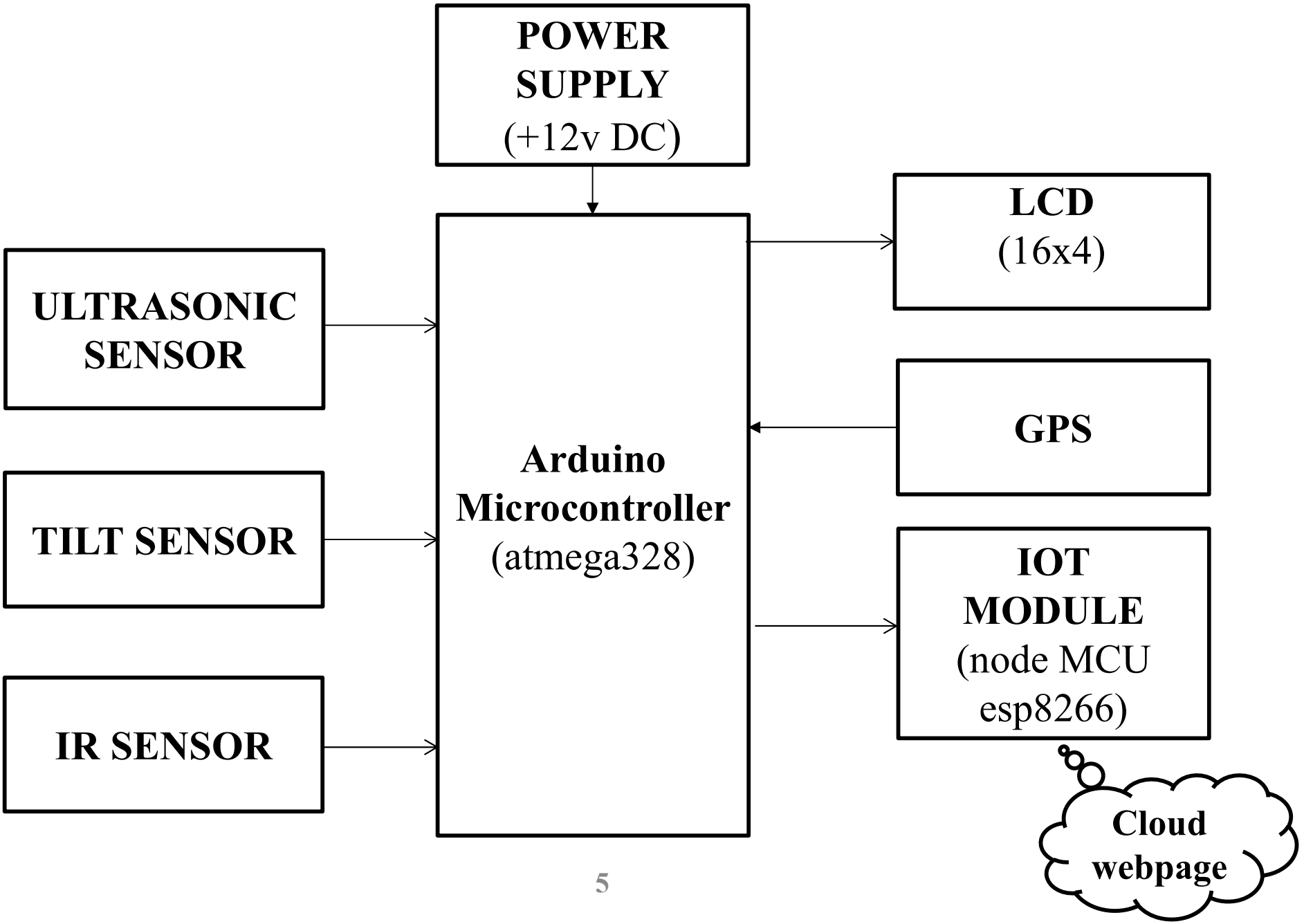
DISADVANTAGES:

- Delay in transmitting the information.
- Cost is high.
- Less accuracy.

PROPOSED SYSTEM

- Our design employs an Arduino microcontroller integrated with an IoT module to monitor and address discrepancies along railway tracks. The system utilizes various sensors including ultrasonic detectors to identify the presence of trains or obstacles in proximity.
- Through the combined functionality of tilt, IR, and ultrasonic sensors, the system accurately measures the distance between critical junctures along the railway track.
- Any deviation or obstruction detected triggers a response mechanism to rectify the issue promptl

BLOCK DIAGRAM



ADVANTAGES
(PROPOSED SYSTEM)

- It’s cost is very low compared to existing system.
- Very accurate detection.
- It also checks surface and near surface of the cracking position.
- Transmitting signals are immediately transfer to the stations.
- Accidents are minimized by using this system.
- This helps prevent accidents and ensures the safety of trains and passengers.

APPLICATIONS

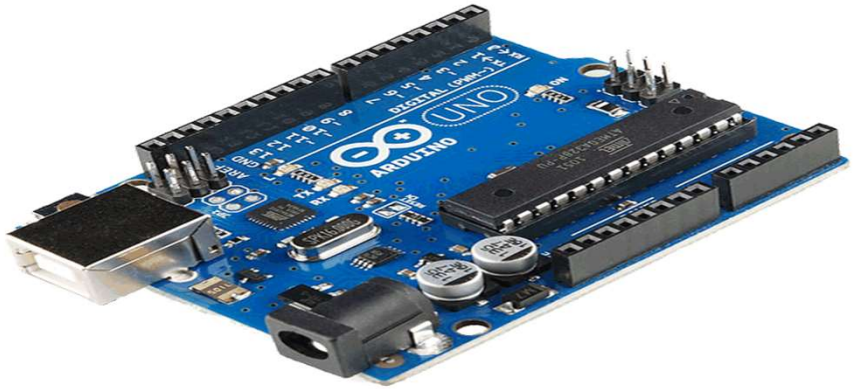
- Wireless applications.
- Railway track damage detection applications.
- Emergency Response Planning.
- Industrial and access control.
- Navigation systems.

HARDWARE COMPONENTS

- Arduino microcontroller (atmega328)
- LCD (16x4)
- Ultrasonic Sensor
- Tilt Sensor
- IR Sensor
- IOT Module (node MCU esp8266)
- GPS
- Power Supply (+12v DC)

ARDUINO MICROCONTROLLER (ATMEGA328)

- The Arduino Microcontroller Atmega328 is a small computer chip found in many Arduino boards like the Uno. It's an 8-bit AVR microcontroller with features like flash memory (32 KB), SRAM (2 KB), EEPROM (1 KB), digital I/O pins (14), analog inputs (6), and built-in communication interfaces. It's popular due to its compatibility with Arduino easy-to-use programming environment, making it versatile for various projects from simple LED blinking to complex IOT applications.

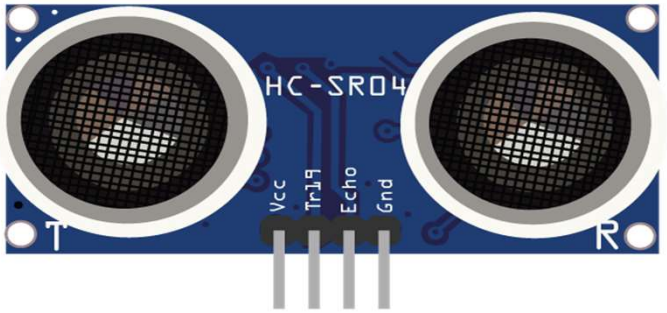


LIQUID CRYSTAL DISPLAY(LCD)

- An LCD (Liquid Crystal Display) is a type of flat-panel display technology commonly used in electronic devices such as TVs, computer monitors, and digital watches. It works by using liquid crystals that can be manipulated to allow or block light, creating images or text. LCDs are popular because they are thin, lightweight, and energy-efficient, making them suitable for a wide range of applications from consumer electronics to industrial equipment.
- **Display Size**: "16x4" means it has 16 characters in each of its 4 rows. So, it can display up to 16 characters horizontally and has 4 lines for displaying text or symbols.

ULTRASONIC SENSOR

- An ultrasonic sensor uses high-frequency sound waves to detect objects' distance by measuring the time it takes for the waves to bounce back. It typically consists of a transmitter and a receiver. These sensors are commonly used in robotics, industrial automation, and object detection due to their reliability and versatility.
- Typically, an ultrasonic sensor consists of a transmitter and a receiver. The transmitter emits ultrasonic pulses, and the receiver detects the reflected waves. Some sensors combine both functions into a single unit.

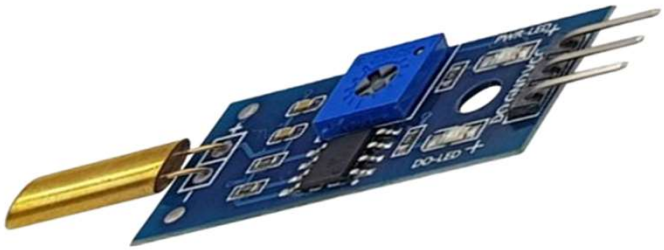


FEATURES

- Provides precise, non-contact distance measurements within a 2 cm to 3 m range
- Simple pulse in/pulse out communication
- Burst indicator LED shows measurement in progress
- 20 mA power consumption
- Narrow acceptance angle
- 3-pin header makes it easy to connect using a servo extension cable, no soldering required.

TILT SENSOR

- A tilt sensor is a device that can detect the tilting or inclination of an object with respect to the horizontal plane. It usually consists of a mechanism that changes its state or outputs a signal when tilted beyond a certain angle. Tilt sensors are commonly used in applications such as electronic stability control systems in vehicles, leveling systems in construction equipment, and gaming controllers to detect movement.

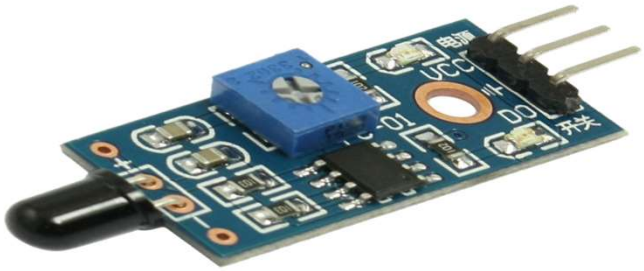


FEATURES

- Tilt sensors can detect angles ranging from a few degrees to a full 360 degrees, catering to various applications with different tilt requirements.
- This refers to the time it takes for the sensor to respond to a change in tilt angle. Faster response times are desirable in applications where real-time monitoring is crucial.
- Tilt sensors are designed to operate within specific temperature ranges. It's important to choose a sensor with a temperature range suitable for the intended application environment.
- Some tilt sensors are designed to minimize power consumption to extend battery life or reduce energy costs.

IR SENSOR

- An IR sensor detects infrared light emitted or reflected by objects. It's commonly used in motion detectors, remote controls, and proximity sensors. The sensor consists of an emitter and a receiver, with the receiver measuring the intensity of the infrared radiation. When an object is detected, it triggers a response, such as turning on a light or activating a device. IR sensors are widely used due to their affordability, low power consumption, and effectiveness in various lighting conditions.

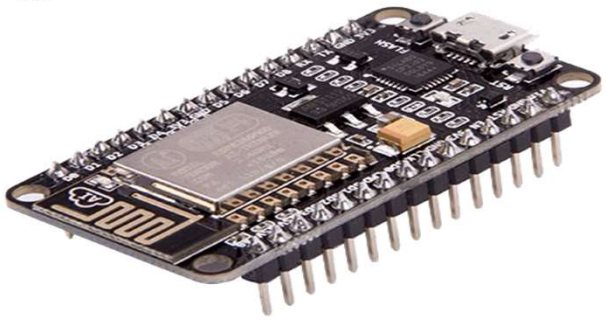


FEATURES

- IR sensors have a specific range within which they can detect objects or heat signatures. This range can vary depending on the sensor type and application, spanning from a few centimeters to several meters.
- IR sensors can employ various detection methods, including passive infrared (PIR), active infrared (AIR), and thermal infrared.
- Response time refers to how quickly the sensor reacts to changes in the detected infrared radiation. Faster response times are desirable in applications requiring real-time detection, such as security systems or motion sensors.

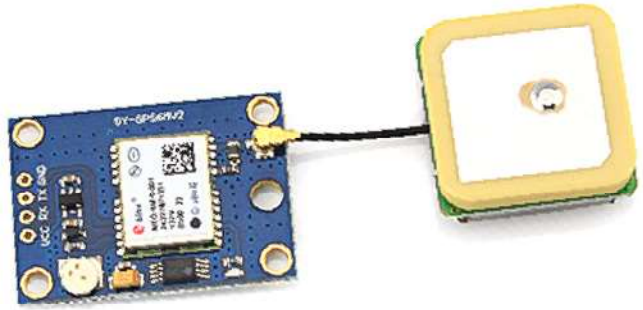
IOT MODULE (NODE MCU ESP8266)

- The Node MCU ESP8266 is a small, low-cost module for IoT projects. It connects devices to the internet wirelessly, enabling remote control and monitoring. With its built-in Wi-Fi capability, it's popular for creating smart home gadgets like door sensors and temperature monitors. It's easy to program using languages like Arduino and Lua, making it accessible to beginners. Overall, the Node MCU ESP8266 is widely used in various applications, from home automation to industrial monitoring.



GLOBAL POSITIONING SYSTEM(GPS)

- GPS, or Global Positioning System, provides location and time information worldwide. It's used in navigation systems, mapping, fleet tracking, and emergency services. This satellite-based technology is integrated into various devices like smart phones and car navigation systems.



POWER SUPPLY

- The 12v advanced step-down transformer is powered by an AC source. The 12v AC transformer is rectified by means of a diode connection. A capacitor separates the 12v DC diode bridge yield.
- Its versatility makes it essential for powering a wide range of devices in different applications, from home setups to industrial machinery.

SOFTWARE REQUIREMENT

Operating System

- Windows 10

Front end software

- PHP
- Proteus
- Keil C

Back end software

- My-SQL
- Embedded C

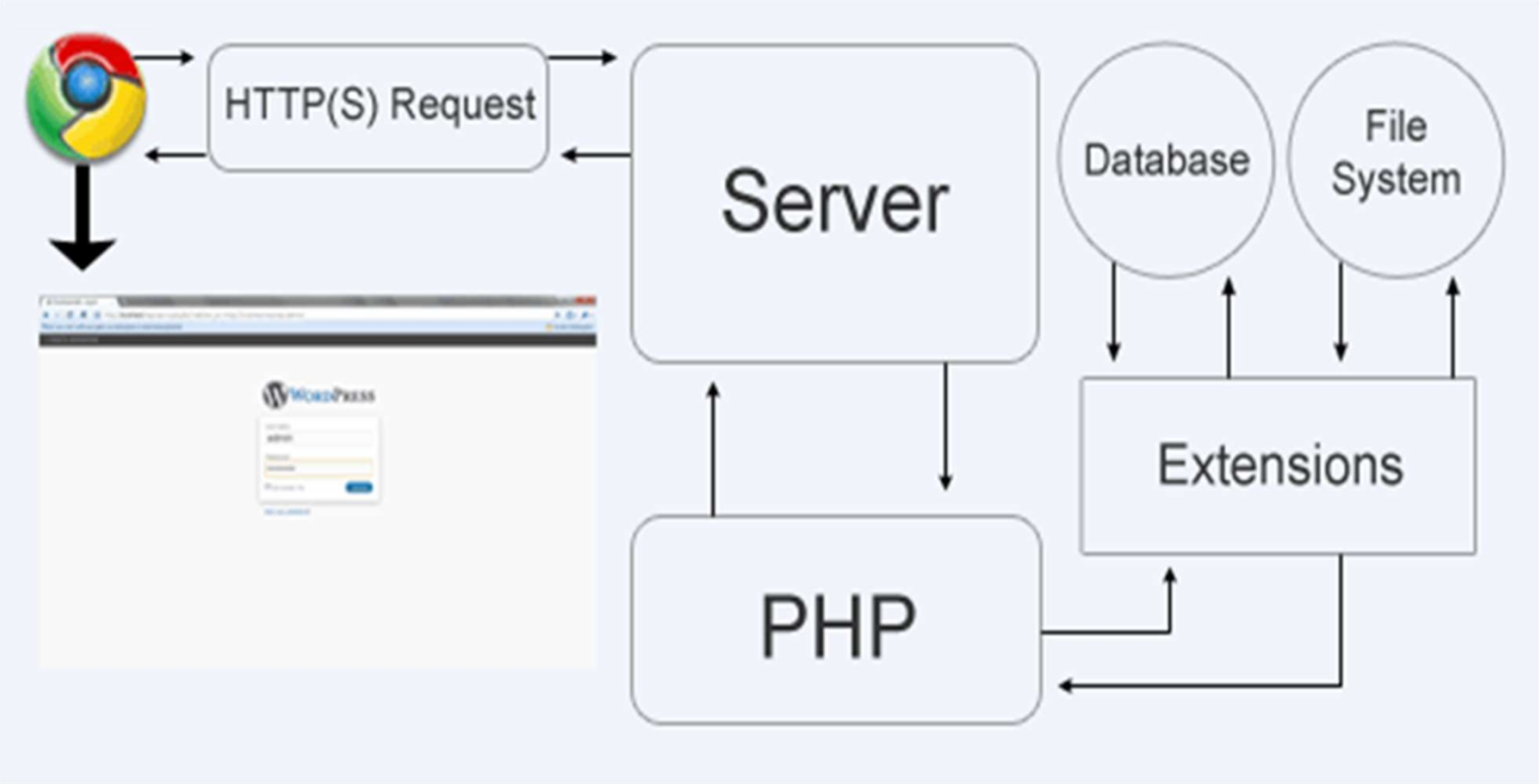
FRONT-END SOFTWARE

- The front end is the part of a software application or website that users interact with directly. It includes everything users see, touch, click, or interact with on their screens.
- This encompasses the design, layout, content, and user interface elements like buttons, forms, menus, and images.
- In simpler terms, it's the part of a digital product that users directly engage with, shaping their experience and interaction.

PHP (PERSONAL HOME PAGE)

- PHP Hypertext Preprocessor (the name is a recursive acronym) is a widely used, general-purpose scripting language that was originally designed for web development to produce dynamic web pages.
- PHP code is embedded into the HTML source document and interpreted by a web server with a PHP processor module, which generates the web page document.
- As a general-purpose programming language, PHP code is processed by an interpreter application in command-line mode performing desired operating system operations and producing program output on its standard output channel.

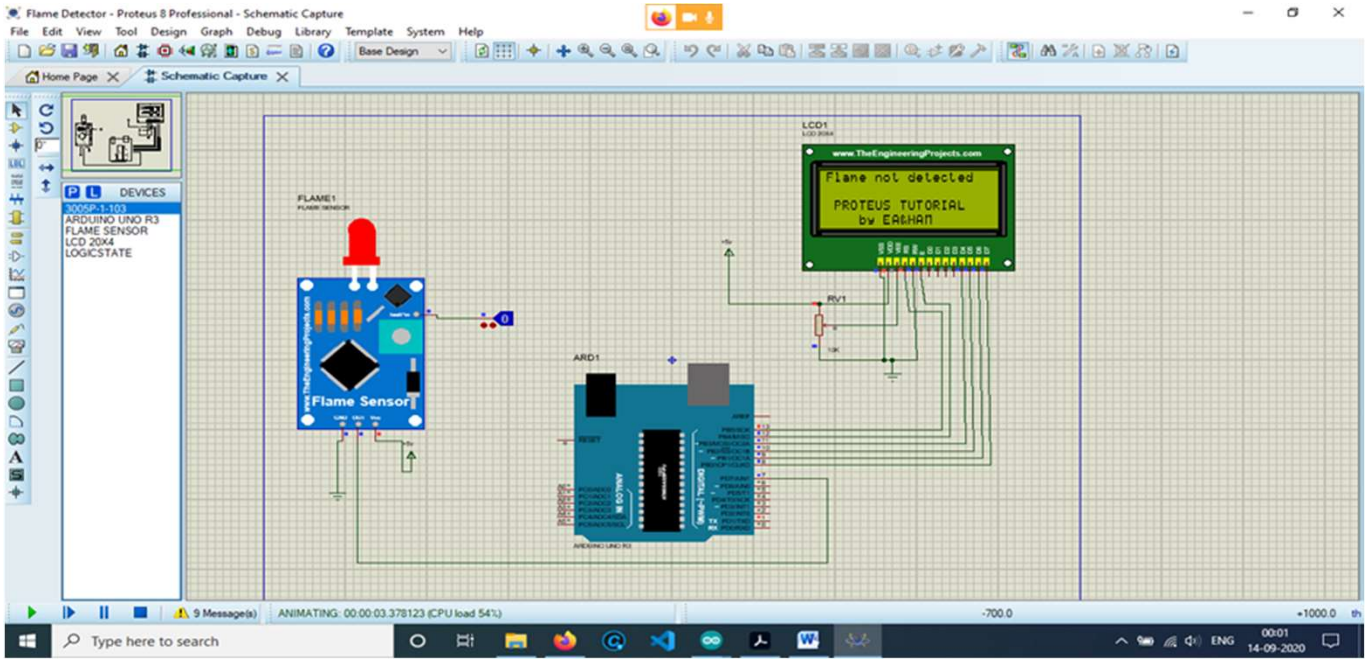
- It may also function as a graphical application. PHP is available as a processor for most modern web servers and as standalone interpreter on most operating systems and computing platforms.



PROTEUS

- Proteus is a widely used software tool primarily for electronic design automation (EDA) and simulation of electronic circuits. It offers a comprehensive suite of tools for designing, testing, and simulating circuits before they are physically implemented.
- Proteus stands as an indispensable tool in the realm of electronic design automation, offering a comprehensive suite of features tailored to circuit design and simulation.
- With its intuitive interface and vast component library, users can swiftly craft intricate schematics, paving the way for accurate simulations of electronic circuits.
- Its simulation engine, capable of handling mixed-mode circuits and microcontroller-based systems, empowers designers to predict and analyze circuit behavior with precision.

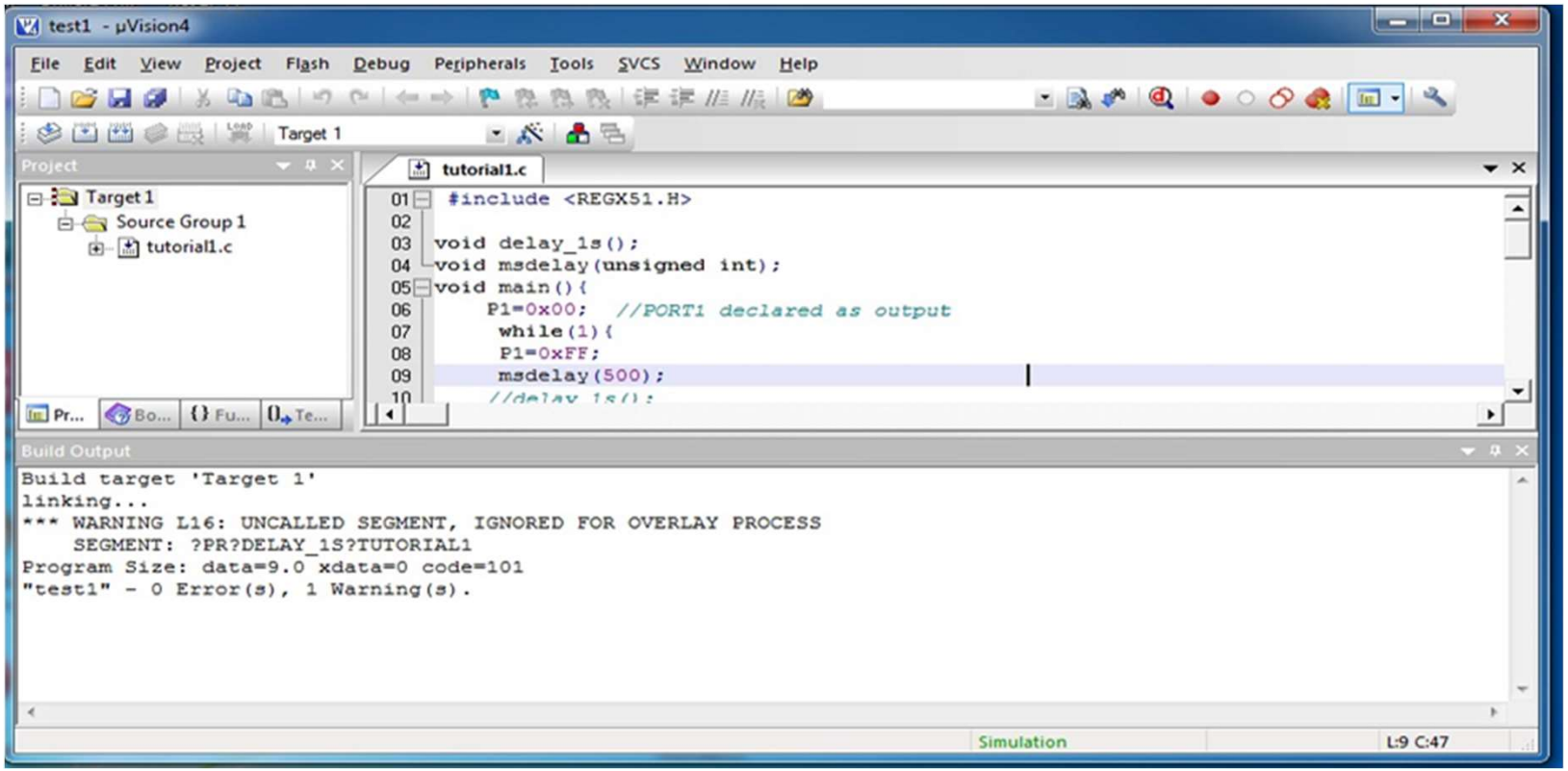
- Beyond simulation, Proteus seamlessly integrates PCB design capabilities, facilitating the transition from schematic to board layout Whether in educational settings or professional environments, Proteus serves as a reliable companion for engineers, educators, and enthusiasts alike.



KEIL C

- Keil C, commonly referred to as Keil μ Vision, is a widely utilized integrated development environment (IDE) specifically designed for programming microcontrollers, particularly those based on ARM architecture.
- Keil C provides a comprehensive toolset for embedded software development, offering a user friendly interface coupled with powerful features tailored to the needs of embedded systems designers.
- At its core, Keil C leverages the C programming language, enabling developers to write efficient and portable code for microcontroller applications. With its seamless integration of the Keil Compiler, developers can compile, debug, and optimize their code within a unified environment.

- Moreover, Keil C supports a wide range of microcontroller families, providing extensive device support and peripheral libraries to streamline development across various platforms.



BACK-END SOFTWARES

- The "back end" of a software application or website is essentially the behind-the-scenes part that users don't directly interact with. It includes the server, database, and application logic that work together to power the front end and enable its functionality.
- In other words, while the front end focuses on what users see and interact with, the back end handles the processing, storage, and management of data. For example, when you submit a form on a website, the data is typically sent to the back end where it's processed, stored in a database, and then retrieved when needed.
- Overall, the back end is responsible for the server-side operations that support and enable the functionality of the front end.

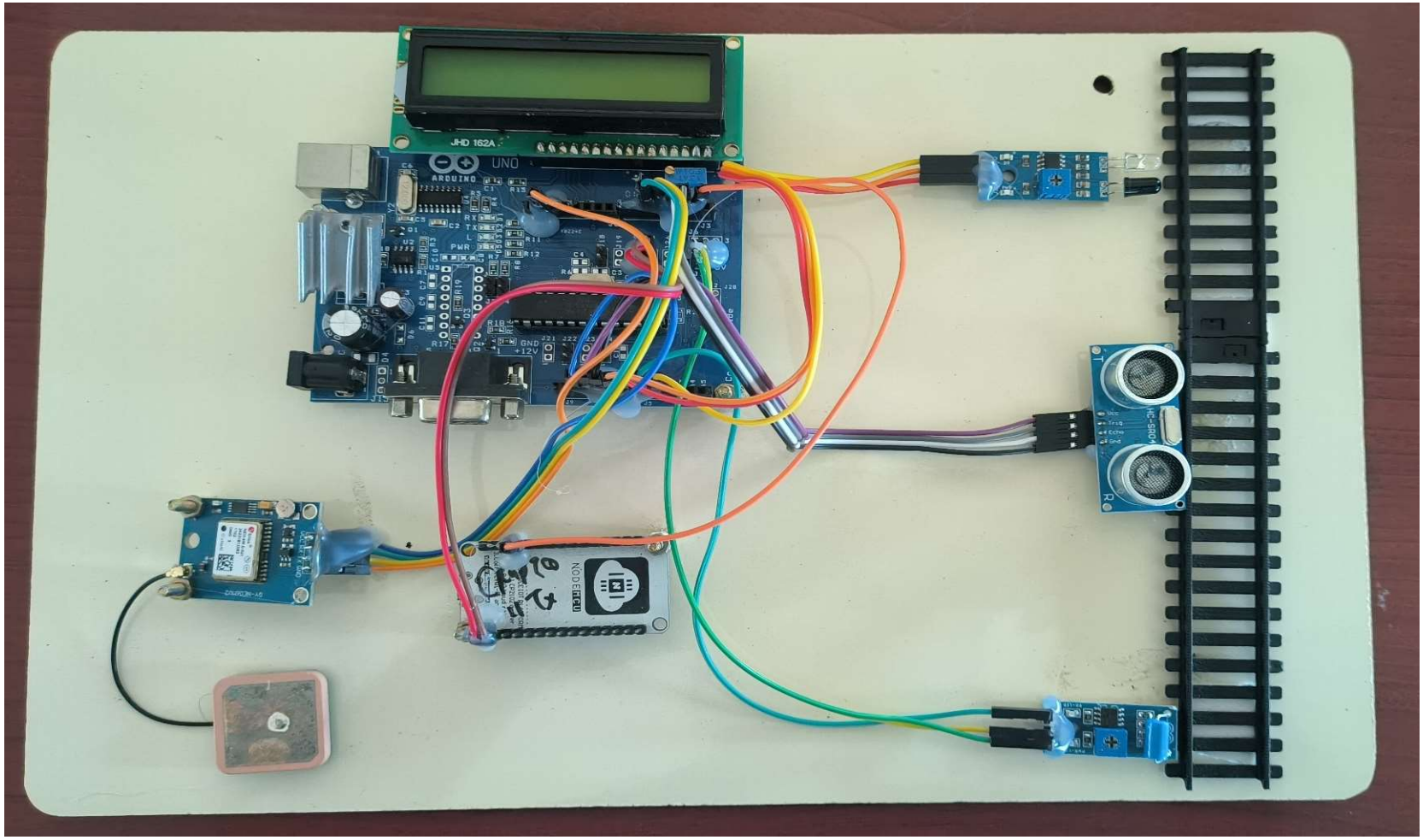
My SQL

- MySQL is a popular open-source relational database management system (RDBMS) that is widely used for storing and managing structured data. It is often used in web development alongside programming languages like PHP, Python, and JavaScript to create dynamic websites and web applications.
- MySQL allows users to create, read, update, and delete data using a structured query language called SQL (Structured Query Language). It supports features like transactions, replication, and clustering, making it suitable for a wide range of applications from small-scale websites to large-scale enterprise systems.
- Overall, MySQL provides a reliable and scalable solution for storing and managing data, making it a cornerstone technology in the world of web development and database management.

EMBEDDED C

- Embedded systems programming is different from developing applications on a desktop computers.
- Embedded devices have resource constraints(limited ROM, limited RAM, limited stack space, less processing power) Components used in embedded system and PCs are different; embedded systems typically uses smaller, less power consuming components.
- Embedded systems are more tied to the hardware. Two salient features of Embedded Programming are code speed and code size. Code speed is governed by the processing power, timing constraints, whereas code size is governed by available program memory and use of programming language.

PROJECT KIT IMAGE



CONCLUSION

- The approach taken is capable, if there are any, of detecting flaws and obstacles on the surface. The method proposed has lots of advantages over conventional detection approaches that include minimal cost, reduced energy consumption, efficient detection system without human involvement and shorter analytical times.
- With this prototype, train collisions and derailments can be easily prevented to save many lives. It is also very beneficial for railroad operations testing units. And we can also notice the position failure and the system used in this, and also the location data is sent to the default mobile number. So that this enables us in rail line preservation and control as well.

- When we use the detector model for monitoring and we can claim that it is a fusion energy vehicle. The result shows that this exciting new technology will keep increasing the efficiency of the safety features for rail infrastructure. We can prevent accidents of up to 70% by enforcing these functionalities in the real-time implementation.
- Areas where manual testing is not feasible with this vehicle, such as in shallow coalmines, mountainous areas and thick and deep forests regions, can be easily carried out. When this vehicle is used for railway inspections and breakage detection, automatic SMS will be sent to a predetermined mobile number if cracks or abnormalities are identified by the device sensors. This will lead without errors to the management and control of the state of the railway tracks, and thus to the preservation of the tracks in good condition.

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THANK YOU...