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IOT Based (LDAR) Level, Distance, Angle, RPM Meter using ESP8266 Controller

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ABSTRACT:

In this project we have merged a few sensors together to measure distance using infrared light sensors, measure length using a rotary encoder and a wheel, measure level with an MPU6050 module but also angles with that same module and finally measure RPMs with another kind of IR sensor. Everything is inside in acrylic case that we have designed and we have a battery and a charging module with USB Type-B as well. To control the modes and more we have 4 touchless buttons based on capacitance that could be below the acrylic case. To print the value, we use an OLED display and the case also has a laser module pointer.

Introduction:

In this project we made one gadget for measure various units like RPM, Level, Angle, Distance that's called LDAR meter. Measurement is the process of assigning numerical values to physical quantities or properties of objects, phenomena, or systems. It involves comparing the quantity being measured with a standard unit of measurement to determine its magnitude. Measurement is essential for understanding, quantifying, and analyzing various aspects of the natural world and human-made systems. The need for measurement of parameters such as RPM (Rotations Per Minute), length, angle, and level is fundamental across various industries and applications. Measurement offers numerous benefits across various domains, including science, engineering, industry, and everyday life. In our LDAR Multi meter we use ESP8266. The ESP8266 is a system on a chip (SOC) Wi-Fi microchip for Internet of Things (IoT) applications produced by Espressos Systems. Given its low cost, small size and adaptability with embedded devices, the ESP8266 is now used extensively across IoT devices. Our system consists of 6 sensors with a separate microprocessor and control unit along with different 6 Nos of sensors and modules i.e. Rotary Encoder, Infrared (IR) sensors, MPU6050 (gyroscope), SHARP GP2YOA21, VL53LOX, ESP8266 (Node MCU) Wi-Fi module. We have selected 2 sensors and this is why. One has good range up to 80cm but the other sensor has better precision but only up to 20cm. So we have used the SHARP GP2Y0A21 to measure distance up to 80cm with a resolution of centimeters. Then we have used the VL53L0X sensor to measure distance up to 20cm with a millimetres precision. Both are using infrared light to measure distance but the VL53L0X is laser based and has better precision.

Methodology:

A systematic research methodology is adopted keeping in mind the ultimate goal of a fully functional and autonomous gadget Which Measure Unites like angle, length, distance, rpm, level. A decentralized top down approach is used for this project.

The project is divided in to Six modules. Each module is independent from one another. Different phases were carried out step by step, starting from basic sensor testing and proceeding towards obstacle avoidance, object detection, object tracking and data transmission. Due to the decentralized approach, all modules and sensors act independently. Data obtained by different sensors and modules is collectively analysed and an intelligent decision based on information obtained is made that instruct the controller to show highly accurate value on display. Two separate units are used i.e. microprocessor and a controller. The processing is carried out by microprocessor and the information obtained by the sensors is controlled by a controller i.e. Arduino board. A serial communication between microprocessor and controller is established to exchange the various measurement information.

This approach was most suitable because if there is a fault in any one of the modules then it would not affect the entire system. Hence this provides the best possible results by maintaining accuracy.

Working:

1. **Level & Angle:**

The MPU6050 module integrates a gyroscope and accelerometer, allowing it to measure angular velocity and acceleration in multiple axes. By processing the data from these sensors, the module an determine the orientation of the device relative to the Earth's gravitational field. The ESP8266 module reads the sensor data and calculates the angles of tilt or rotation based on the measured accelerations and angular velocities. The angle measurements can then be displayed on a user interface or transmitted wirelessly for remote monitoring.

2. Distance using SHARP GP2Y0A21 IR Analog Distance Sensor:

The SHARP GP2Y0A21 IR Analog Distance Sensor emits infrared light and measures the intensity of the reflected light to determine the distance to an object. The sensor converts the received light intensity into an analog voltage output, which varies inversely with distance. The ESP8266 module reads this analog voltage using one of its analog input pins and processes the data to calculate the distance. The distance measurements can then be displayed on a serial monitor or transmitted wirelessly for remote monitoring.

3. RPM:

The working principle of the IoT-based RPM meter remains the same as the standalone version. The IR sensor module detects interruptions in the infrared light beam caused by the rotating object's reflective surface, and the ESP8266 microcontroller calculates the RPM based on these interruptions. However, in this version, the ESP8266 is also configured to transmit the RPM data to an online platform via Wi-Fi for remote monitoring.

4. Distance measure using VL53L0X sensor Time-of-Flight: -

The VL53L0X sensor emits a laser pulse towards the target object and measures the time it takes for the pulse to travel to the object and back. By analysing the time-of-flight of the laser pulse, the sensor can accurately determine the distance to the target object. The ESP8266 module reads the distance data from the VL53L0X sensor and processes it to calculate the distance. The distance measurements can then be displayed on a user interface or transmitted wirelessly for remote monitoring.

5. Distance measure using Rotary Encoder, Wheel: -

The rotary encoder is attached to a wheel, and as the wheel rotates, the rotary encoder generates pulses that can be counted to determine the distance travelled by the wheel. The ESP8266 module reads the pulse count from the rotary encoder and processes it to calculate the distance travelled by the wheel. The distance measurements can then be displayed on a user interface or transmitted wirelessly for remote monitoring.

Objective:

The LDAR Multi Meter must follow the following objectives: -

1. The LDAR Multi Meter must be capable of accurately Measurement.
2. It should be capable of taking various Measurements from various sensors.
3. The LDAR Multi Meter must be capable to show measurement on mobile by using IOT System

Block Diagram: -

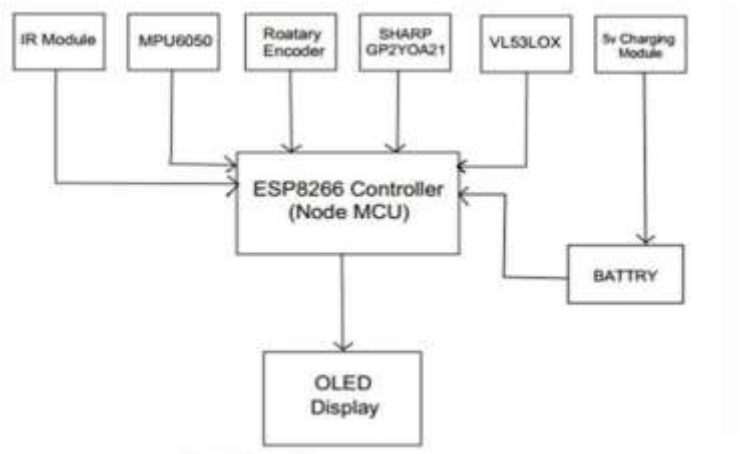
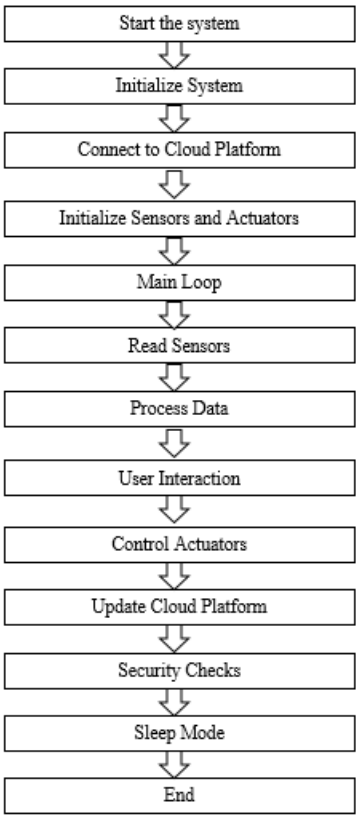


Fig 1 . Block diagram of LADR Meter

Algorithm : -



Flow-chart : -

Step 1: Start the system

Step 2: Initialize System

Step 3: Connect to Cloud Platform

Step 4: Initialize Sensors and Actuators

Step 5: Main Loop

Step 6: Read Sensors

Step 7: Process Data

Step 8: User Interaction.

Step 9: Control Actuators

Step 10: Update Cloud Platform

Step 11: Security Checks

Step 12: Sleep Mode

Step 13: End

Conclusion

After completing all the stuff according to this connection format, the LDAR Multi meter will be ready to measure. The main difficult thing about this is building an algorithm on which the working behavior of this multi-meter depends. So, the main object of this phase is to understand the algorithm and the connection diagram. In this project, the LDAR Multi meter has been made to Masseur Various Units.

This LDAR Multi meter has an ESP8266 controller is collect of the reading from various sensors and sends the information to clawed storage and bling Application will show all the reading on the display of mobile over using IOT system. The LDAR Multi meter will be lastly finished.

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