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# MOTORBIKE TELEMETRY


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**Subject:** IoT Domain Analyst

**Course code:** ECE3502

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## ABSTRACT:

The number of motorcycles on the road has increased in almost every country according to Eurostat. Although the total number of motorcycles is lower than the number of cars, the accident rate is much higher. A large number of these accidents are due to human errors. This motorbike telemetry project aims to design and implement a telemetry system that can monitor and transmit real-time data from a motorbike to a remote location. The system will include sensors to collect data on factors such as speed, acceleration, braking, and fuel consumption. This data will be transmitted via wireless communication to a remote server where it can be analysed for various purposes such as performance optimization, safety improvements, and maintenance scheduling. The system will be designed to be cost-effective, easy to install, and reliable, with the potential to be scaled up for use in larger fleets of motorbikes.

## INTRODUCTION:

Motorbike telemetry is an emerging technology that allows for the remote monitoring and analysis of real-time data from a motorbike. With the increasing popularity of motorbikes as a mode of transportation, there is a growing need to improve their safety, performance, and maintenance. motorbikes can also be dangerous if not operated safely or properly maintained. Therefore, monitoring the performance and condition of motorbikes is crucial for ensuring the safety of riders and reducing the risk of accidents. Motorbike telemetry can provide valuable insights into the performance of a motorbike, enabling users to optimize its operation and maintenance, and ultimately increase its lifespan. This project aims to design and implement a motorbike telemetry system that can collect and transmit real-time data on various factors such as speed, acceleration, braking, and fuel consumption. The data collected by the system will be transmitted wirelessly to a remote server where it can be analyzed and used for various purposes such as performance optimization, safety improvements, and maintenance scheduling. The project has the potential to make a significant impact on the motorbike industry by providing a valuable tool for monitoring and optimizing motorbike performance and safety.

## OBJECTIVE:

The different objectives for motorbike telemetry are, One objective is to develop a telemetry system for motorbike riders that is easy to replicate. Another objective is to learn from motorcycle telemetry data to identify trends and improve riding style. A third objective is to predict motorcyclist stress using telemetry data from the motorcycle, road shape, and stress-related measures from physiological signals. The aim is to estimate upcoming stress levels and improve road safety through machine learning and recommender systems. The more objectives for Motor bike telemetry are:

- Design and develop a telemetry system that can monitor and collect real-time data from a motorbike.
- Implement sensors that can accurately measure important parameters such as speed, acceleration, braking, and fuel consumption.
- Establish a wireless communication system that can transmit the collected data from the motorbike to a remote server for storage and analysis.
- Create a user-friendly dashboard that displays the collected data in an easy-to-understand format.
- Analyze the collected data to identify patterns, trends, and areas for improvement in motorbike performance, maintenance, and safety.
- Use the analyzed data to optimize the performance and efficiency of the motorbike, reduce maintenance costs, and improve rider safety.

**COMPONENTS REQUIRED:**

- 1 x **Arduino** Uno R3
- 2 x Ultrasonic ranging module **HC-SR04**, Used to determine the shock absorber extension (Front & Back)
- 1 x Infrared Thermopile Contactless Temperature Sensor **TMP006,** used to determine the Tyre Temperature (can measure the External temperature also - Optional)
- 1 x **GPS-NEO7M**, used to determine the GPS Position, speed, altitude
- 1 x **ADXL345**, used to evaluate the G acceleration in 3 axis and compute the Lean Angle and the Wheelie Angle
- 1 x **LM35DT** in order to determined the external Temperature
- 1 x **HC-05**, Bluetooth module, to communicate between Arduino and the windows phone
- 1 x **Power supply**

## LITERATURE REVIEW:

In this Literature Survey we will study about the papers based on Motor Bike Telemetry and we will conclude the overall content of the respective research papers. The use of telemetry systems in the automotive industry has been extensively researched and documented in literature. However, the application of telemetry systems to motorbikes is relatively new and has been gaining attention in recent years.

“***Telemetry system for monitoring motorbike performance and rider behaviour" by Al-Maqtari et al. (2016)***, In this study proposed a telemetry system for monitoring motorbike performance and rider behaviour. The system was tested on a group of riders and showed potential in improving rider safety and reducing the risk of accidents. The study concludes that telemetry systems can be used to provide real-time feedback to riders on their driving behavior, leading to safer and more efficient driving.

***"Telemetry system for monitoring fuel consumption and emissions from a motorbike" by Joseph et al. (2018),*** the study developed a telemetry system for monitoring fuel consumption and emissions from a motorbike. The system was tested on a group of motorbikes and showed potential in optimizing fuel efficiency and reducing emissions. The study concludes that telemetry systems can be used to provide real-time feedback on fuel consumption, leading to more efficient and eco-friendly driving**.**

***“Low-cost telemetry system for monitoring the condition and performance of electric motorbikes" by Ahmad et al. (2019),*** the study proposed a low-cost telemetry system for monitoring the condition and performance of electric motorbikes. The system was tested on a group of electric motorbikes and showed potential in optimizing maintenance and performance. The study concludes that telemetry systems can be used to monitor and analyse the performance of electric motorbikes, leading to more efficient and reliable driving.

***“Development of a telemetry system for motorcycles and its application to race engineering" by Nakamura et al. (2011),*** this paper describes the development of a telemetry system for motorcycles used in racing. The system included sensors for measuring various parameters such as engine speed, throttle position, and suspension travel. The collected data was transmitted wirelessly to a laptop for real-time analysis and used to optimize the performance of the motorcycle during races. The study concluded that telemetry systems can be used to improve the performance of motorcycles in racing by providing real-time feedback to engineers**.**

***"An intelligent motorbike telemetry system for accident detection and prevention" by Hussain et al. (2018),*** this paper proposed an intelligent motorbike telemetry system for accident detection and prevention. The system included sensors for measuring parameters such as speed, acceleration, and tilt angle. The collected data was transmitted wirelessly to a remote server for analysis and used to detect and prevent accidents. The study concluded that telemetry systems can be used to improve the safety of motorbikes by providing real-time alerts to riders and other stakeholders.

***"Design of a wireless telemetry system for motorcycle engine parameter monitoring and diagnosis" by Sharma et al. (2020)***, this paper proposed a wireless telemetry system for monitoring and diagnosing engine parameters of motorcycles. The system included sensors for measuring parameters such as engine speed, temperature, and oil pressure. The collected data was transmitted wirelessly to a remote server for analysis and used to diagnose and optimize the performance of the motorcycle. The study concluded that telemetry systems can be used to improve the maintenance and performance of motorcycles by providing real-time diagnostic information to mechanics**.**

***One study published in the Journal of Engineering and Applied Sciences(2016)*** proposed a telemetry system for monitoring motorbike performance and rider behaviour. The system included sensors for collecting data on speed, acceleration, braking, and cornering. The collected data was transmitted wirelessly to a remote server for analysis and used to provide feedback to the rider on their driving behaviour. The study demonstrated the potential of telemetry systems in improving rider safety and reducing the risk of accidents.

***Another study published in the International Journal of Innovative Research in Science, Engineering and Technology (2018)*** developed a telemetry system for monitoring fuel consumption and emissions from a motorbike. The system included sensors for measuring fuel flow rate, exhaust temperature, and exhaust gas composition. The collected data was transmitted wirelessly to a remote server for analysis and used to optimize the fuel efficiency of the motorbike. Furthermore**, a research article published in the IEEE Sensors Journal (2019)** proposed a low-cost telemetry system for monitoring the condition and performance of electric motorbikes. The system included sensors for measuring battery voltage, current, and temperature, as well as motor speed and torque. The collected data was transmitted wirelessly to a remote server for analysis and used to optimize the maintenance and performance of the electric motorbike.

Overall, the literature survey suggests that telemetry systems have great potential in improving the performance, efficiency, and safety of motorbikes. The proposed system in this project will build upon the existing research and aims to provide a cost-effective, reliable, and scalable solution for monitoring and analysing motorbike data.

## METHODOLOGY:

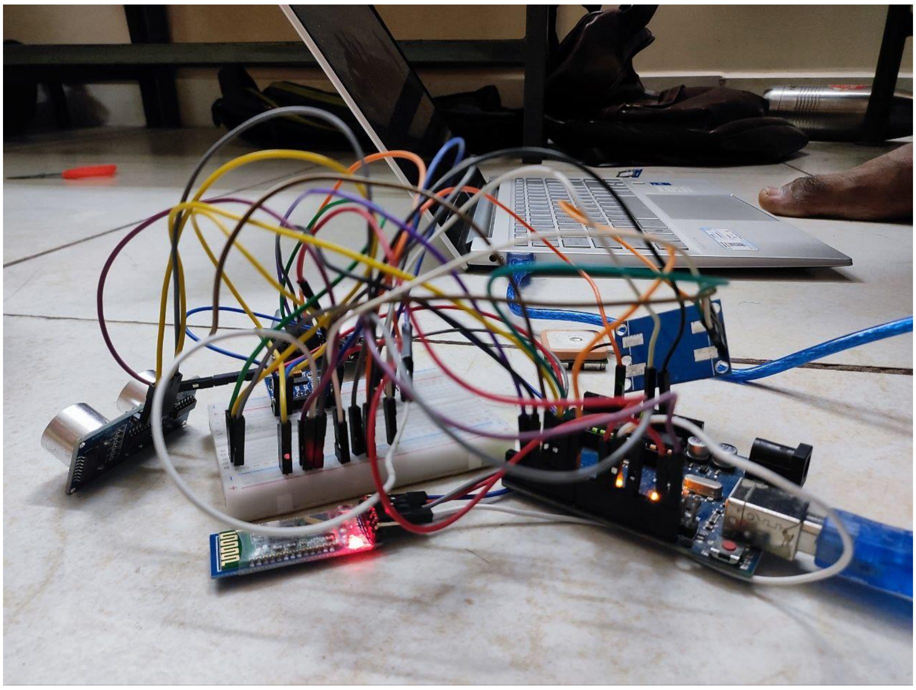
The methodology for motorbike telemetry involves collecting data from various sensors such as GPS, IMU, Temperature sensor, and physiological signals. The data can be used to predict motorcyclist stress levels and improve road safety through machine learning and recommender systems. The telemetry system can be developed using Arduino and wireless interface with the cell phone, data transmission, web-app, data analytics, and GPS communication. The telemetry system can also be used for data logging and GPS tracking to measure speed, RPM, tire temperature, and braking pressure4. The data can be analysed to identify trends in riding style and improve riding skills. The telemetry system can be replicated easily to make it accessible to all motorcycle enthusiasts The methodology for implementing a motorbike telemetry system typically involves the following steps:

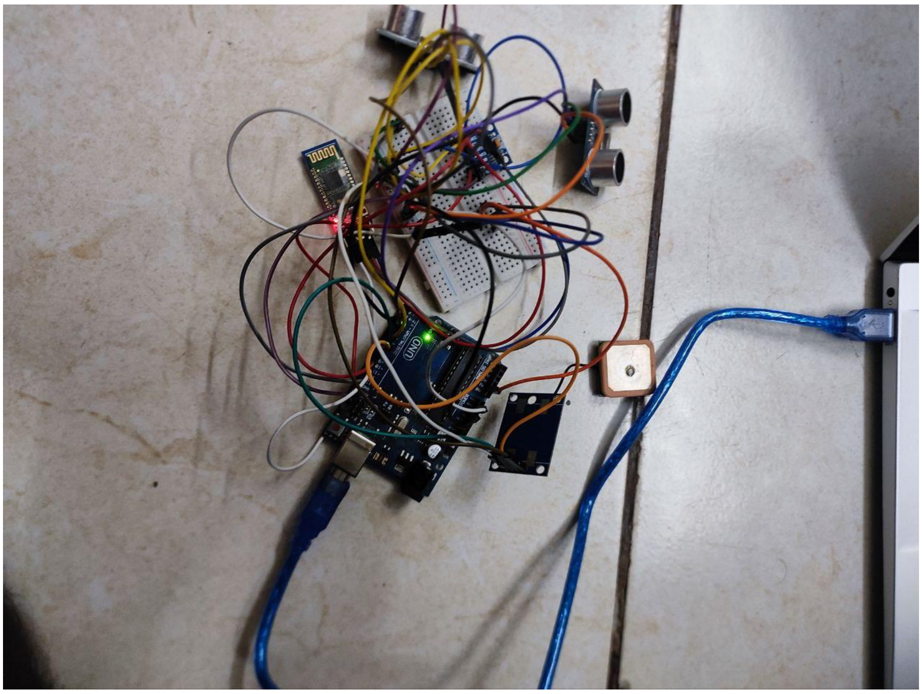
- Sensor selection: Determine the sensors required to measure the relevant parameters such as speed, acceleration, throttle position, engine temperature, etc.
- Hardware design: Design the telemetry hardware, including the microcontroller, wireless communication module, power supply, and sensor interface.
- Firmware development: Develop the firmware for the microcontroller to read data from the sensors, process the data, and transmit it wirelessly to a remote server.
- Cloud-based platform: Set up a cloud-based platform to receive and store the telemetry data. This can include data visualization, analysis, and reporting tools.
- Data analysis: Analyse the telemetry data to identify patterns, trends, and anomalies. This can involve statistical analysis, machine learning algorithms, and data visualization.
- User interface: Develop a user interface for accessing the telemetry data, including real-time dashboards, alerts, and reports.
- Testing and validation: Test the telemetry system on a motorbike and validate its performance and accuracy.

- Deployment: Deploy the telemetry system on a larger scale, including multiple motorbikes and different locations.

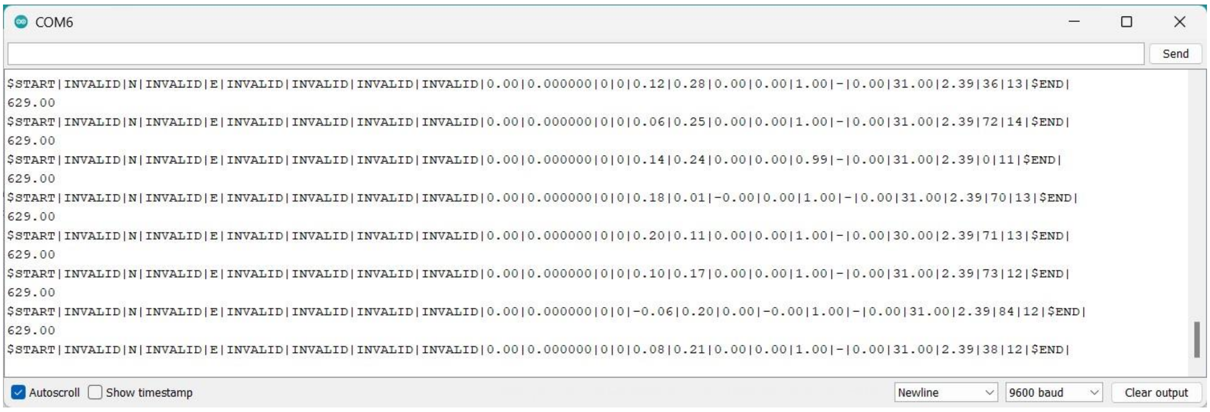
It is essential to follow best practices for hardware design, firmware development, and data analysis to ensure the telemetry system is reliable, accurate, and scalable. Additionally, it is crucial to prioritize data privacy and security to protect the sensitive data collected from the motorbike.

**WORKING MODEL:**





## PROBLEM FACED:




At first we couldn't get the GPS coordinate  but at last we got the output.

## CODE SCREENSHOT:

```
#include <SoftwareSerial.h>
#include <Wire.h>
//
#include <TinyGPS++.h>
//
#include <ADXL345.h>
//
#include <Adafruit_Sensor.h>
#include "Adafruit_TMP006.h"
//
#include <NewPing.h>

const float alpha = 0.5;

double fXg = 0;
double fYg = 0;
double fZg = 0;

double refXg = 0;
double refYg = 0;
double refZg = 0;

static const int RXPin = 6, TXPin = 7;
static const int GPSBaud = 9600;

// The TinyGPS++ object
TinyGPSPlus gps;
double Start_LAT = 0.0; // Per calcolo Distanza percorsa
double Start_LNG = 0.0; // Per calcolo Distanza percorsa
bool Start_CalculateDistance = false; // Per calcolo Distanza percorsa

// The serial connection to the GPS device
SoftwareSerial ss(RXPin, TXPin);


int i = 0;
ADXL345 acc;


//HC RS04 - 1 (front)
int triggerPort = 2;
int echoPort = 3;
```

```
NewPing sonar(triggerPort, echoPort, 200 );     // NewPing setup of pins and maximum distance.
NewPing sonar2(triggerPort2, echoPort2, 200 );  // NewPing setup of pins and maximum distance.



/*****************************************
    Variables for Bluetooth Functions
 ****************************************/
SoftwareSerial BTSerial(10, 11); // RX | TX



/*****************************************
    Variables for Audio Sensor Functions - Optional
 ****************************************/
int sensorPin = A0;       // select the input pin for the potentiometer
int ledPin = 13;          // select the pin for the LED
double sensorValue = 0;   // variable to store the value coming from the sensor




/*****************************************
    Variables for External Temperature (LM35) - Optional
 ****************************************/
int TempExtPin = A1;                // select the input pin for the ExternalTemperature LM35
float celsius = 0, farhenheit = 0;  // temperature variables
float millivolts;                   //dichiarazione di variabile tensione (float è per i numeri con la virgola)
int sensor;

/*****************************************
    Variables for TMP006  Functions
 ****************************************/
Adafruit_TMP006 tmp006;


void setup()
{
  pinMode(9, OUTPUT);                   // this pin will pull the HC-05 pin 34 (key pin) HIGH to switch module to AT mode
  digitalWrite(9, HIGH);
  Serial.begin(9600);

  // Bluetooth Inizialize
  BTSerial.begin(9600);                 // HC-05 default speed in AT command more
  Serial.println("Setup HC-05 End");

  delay(3000);

  // GPS Inizialize
  Serial.println("Setup GPS START ...");
  ss.begin(GPSBaud);
  delay(3000);
  Serial.println("Setup GPS End");


  // ADXL345 Inizialize
  acc.begin();
  delay(1000);
  Serial.println("Setup ACC End");
  // Sensore audio
  pinMode(sensorPin, INPUT);

  i = 0;

  // HC RS04 Inizialize
```

```
  // HC RS04 Inizialize
  // HC RS04 - 1
  Serial.println("HCSR04_1 - Setup");
  pinMode( triggerPort, OUTPUT );
  pinMode( echoPort, INPUT );
  // HC RS04 - 2
  Serial.println("HCSR04_2 - Setup");
  pinMode( triggerPort2, OUTPUT );
  pinMode( echoPort2, INPUT );




  Serial.println();

}

void loop()
{

  while (ss.available() > 0){
    if (gps.encode(ss.read()))
    {
      //displayInfo();
      if (gps.location.isValid())
        displayInfo();
      else
      {
        delay(5000);
        Serial.println("wait position");
      }
    }
  }

  if (millis() > 5000 && gps.charsProcessed() < 10)
  {
    while(true){
      displayInfo();
    }
    Serial.println(F("No GPS detected: check wiring."));
    while (true);
  }
```

## OUTPUT IN SERIAL MONITOR:

```
$START|12.9730914|N|79.1574604|E|APRIL|SATURDAY|2023|11:30|0.00|-0.15|0.10|0.00|-0.00|1.00|-|0.00|-29.00|2.39|0|0|$END|
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$STAR[illegible]|E|APRIL|SATURDAY|2023|11:30|0.00|-0.02|0.12|0.00|0.00|[illegible]$END|
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```

## CONCLUSION:

In this project we made an attempt for tracking bike’s activities like location, motion, temperature and suspension movement. Using the GPS model, the location co-ordinates is collected. Using this we can find the exact the location of bike. Incase of high-speed driving, there is high chance for accidents. So, Accelerometer is used to monitor the bike direction. It’ll monitor x, y & z axis, we can check whether it’s accident or not. Along with this, suspension movement is measured using the ultrasonic sensors. Tyre temperature is also measured. So, in total a bike’s current location, motion, accidents and suspension health are monitored in the project.

## FUTURE WORKS:

- Create an Azure IoT Hub: You can create an Azure IoT Hub in the Azure Portal. This IoT Hub will act as a centralized hub for all your IoT devices and applications.
- Machine learning and predictive analytics: By using machine learning and predictive analytics algorithms, it is possible to predict failures or malfunctions in the motorcycle's components before they occur. This can help reduce downtime and increase the overall lifespan of the motorcycle.
- Cloud-based analytics: By storing the telemetry data in the cloud, it is possible to perform advanced analytics and machine learning on the data. This can provide deeper insights into the motorcycle's performance and enable predictive maintenance.

## REFERENCE:


1. Telemetry system for monitoring fuel consumption and emissions from a motorbike" by Joseph et al. (2018),
2. Low-cost telemetry system for monitoring the condition and performance of electric motorbikes" by Ahmad et al. (2019),
3. Development of a telemetry system for motorcycles and its application to race engineering" by Nakamura et al. (2011)
4. "Design of a wireless telemetry system for motorcycle engine parameter monitoring and diagnosis" by Sharma et al. (2020),
5. One study published in the Journal of Engineering and Applied Sciences (2016)