 doi:10.20944/preprints202203.0141.v1

Article

Real Time Road Monitoring System

Salik Sirak， Ashir Imran，Mohammed Bilal，Muhammad Ayub

Institute of Business Management, Karachi 75190, Pakistan.

Abstract: We are living in a world where people always strive for the luxuries they can get with less hard work and for these smart systems are developed and established all over the world to make life easier for the people. However, in Pakistan being a third-world country we are unable to achieve better results due to the lack of proper transit from one area to another. Sometimes the roads are not in their optimum conditions and hence people have to face a lot of problems while traveling. In urban areas, people cannot reach their destination in time, in some cases, they damage their vehicles due to the cracks on the roads, in medical emergency patient dies most of the time in their transit from rescuing point to the hospital. Similarly, in rural areas where farmers face countless problems while bringing their yield of the season towards the markets. Therefore, having described the severe damage the bad quality of roads is making. A solution is proposed to solve the problems of both the rural and urban population in our project. The project aims to provide the solution to their problem to a certain extent by monitoring the conditions of the roads. The sensors in the system will calculate the values and send them to the cloud server. The cloud server used is the blynk platform where the data will be stored. Moreover, data can be provided to the government in the future for the timely maintenance of the roads, and hence the citizens and lifestyle of the people will be changed. It is expected that the problems of both urban and rural population will be solved to a greater percentage.

Keywords: rural areas; urban areas; cloud server; monitoring; road monitoring

1. INTRODUCTION

The objectives include the real-time data to be displayed to the user. The system will also display the speed of the vehicle and the system will be able to record and save the roads' data [1]. Furthermore, the data stored by the system must be sent to the cloud server i.e. blynk platform. Having described the collection of data as a pivotal point of the project. Nevertheless, it cannot go by without saying that the data collected of an area must be presented to the regulatory bodies for future use. The fundamental aim of the project is to create a system that effectively monitors the conditions of the roads on which the vehicle is traveling and generates values for the sensors to help the system store the data on the cloud server [2]. The application follow the usibillity guidline because easy to use application have better respone [3]. The values of latitude, longitude, and speed of the vehicle will be displayed through the smartphone application. The need to create this system arose when the people of both rural and urban areas faced a tormenting situation due to the worse conditions of the roads and this situation was also affecting our economy in many ways. Therefore, this system was able to cater to the problem to a certain extent by generating a graph of the data of those roads on which is traveling. An additional feature is that the blynk platform is used which will help in

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 March 2022 doi:10.20944/preprints202203.0141.v1

the live location tracking of the vehicle. Moreover, the best feature is that the data collected by the system will be saved to the cloud server and the data would be available for use to the government regulatory bodies [4].

1.1. Project Scope

The fundamental aim of the project is to create a system that effectively monitors the conditions of the roads on which the vehicle is traveling and generates values for the sensors to help the system store the data on the cloud server. The values of latitude, longitude, and speed of the vehicle will be displayed through the smartphone application. The need to create this system arose when the people of both rural and urban areas faced a tormenting situation due to the worse conditions of the roads and this situation was also affecting our economy in many ways. Therefore, this system was able to cater to the problem to a certain extent by generating a graph of the data of those roads on which is traveling. An additional feature is that the blynk platform is used which will help in the live location tracking of the vehicle. Moreover, the best feature is that the data collected by the system will be saved to the cloud server and the data would be available for use to the government regulatory bodies.

2. LITERATURE REVIEW

The designing process initially posed the problems over how the placement of the GPS sensor and Vibration sensor on the device and the whole system to be portable as possible. Therefore, with the exploration of different ideas, it was decided that the sensors were placed in a horizontal pattern.

The system is designed to explore different ideas

- A CPS programme in which we simulate acceleration profiles for various car types and road profiles. We then extract features from the produced synthetic data in order to detect anomalies in the path.[5]. Having gone through the research it was also found out that the Cyber-physical Systems (CPS) were the area where the project might have inclined. However, the proposed work was to create a system that can monitor both road conditions and display the data on the application.
- The VIMS system is made up of both hardware and software. A laptop computer, a data acquisition module, an accelerometer, and a GPS logger make up the hardware [6]. Having described this device, the hardware and software conditions sound optimistic. However, this hardware process would have required a laptop for the working and controlling. Therefore, it was not preferred because it would cause the overall system less handy and portable. Hence, research moved to another location.

 doi:10.20944/preprints202203.0141.v1

- In addition to offering a generic Internet-of-Things platform [7], the proposed solution integrates novel energy-efficient phone-orientation-agnostic accelerometer analytics in phones, which decreases the amount of data that must be exchanged the Internet between the phone and the back-end [8]. The device orientation scheme would have resulted in a better understanding of the GPS details. Conversely, this would have resulted in the system becoming too complex i.e. addition of the accelerometer to the system would add the increase in the cost, complexity, and designing extension. Besides, the proper functionality of the accelerometer would also be a less dependable task.
- Last but not least, one more area where the project outcome would have been increased is the real-time data transfer to the cloud server [9]. Smartphones are put within vehicles and pushed along selected road sections to collect data for analysis in the experiment. Data filtering, matching with position and reference data, sectioning, and frequency domain analysis are all part of the analysis [6].
- Improving the deplorable road conditions in rural areas would have a direct effect on farmer productivity. Outputs could be significantly improved due to the ease of shipping farm materials and the easier access of experts and extension staff to farms. Access to knowledge and agricultural technologies, for example, may aid farmers in preventing or controlling disease outbreaks. They'll have easy access to improved crop varieties as well. Farmers who have access to high-yielding, insect- and disease-resistant crops produce more and experience less losses. [5]
- Where consumers do not have access to smart devices, reaching out to them and creating active relationships to assist them in decision-making is difficult. For such a scenario, this study proposes an IoT-based device model for collecting, processing, and storing real-time traffic data. The goal is to improve mobility by providing real-time traffic alerts on traffic congestion and unusual traffic incidents via roadside message units. Citizens would be able to save time by receiving these early-warning messages, particularly during peak hours. In addition, the device broadcasts traffic alerts from the authorities [10].
- A real-time traffic monitoring system based on evolving vehicular communication systems is proposed in this paper. The system allows for more reliable, accurate, and granular traffic monitoring. When compared to other methods, the cluster-based V2X traffic data collection mechanism will capture more than 99 percent of the available data while reducing overhead by a quarter [11].

 doi:10.20944/preprints202203.0141.v1

- This paper outlines a real-time road traffic monitoring system based on integrated mobile field devices (GPS/GSM/IOs) that function in conjunction with advanced GIS-based application software to provide on-the-fly authentications for real-time monitoring and security enhancement. The system is being developed as a completely automated, continuous, real-time monitoring system that transmits data between target GPS receivers and a central processing device using GPS sensors and Ethernet and/or serial port communication techniques.[8]
- In this paper, we propose a device that learns from data obtained from built-in sensors of a smartphone installed within the vehicle to track road conditions in real time. We created a simple learning algorithm that enhances accuracy by communicating with the server and continuously monitoring road conditions. The algorithm is based on k-means clustering and our experimental results show that it can classify road conditions based on the accelerometer data with 88.67% accuracy [12].
- The research presented here proposes a scalable architecture based on Big Data technology that can process real-time traffic data collected by 349 inductive loop counters installed in
  the Slovenian road network. The primary aim is to propose an approach that national road operators will use to track the current state of the road network in real time [13].
- The paper proposes a system for detecting passing vehicles and classifying them using mobile devices (smartphones) and Bluetooth beacons. The tasks of traffic monitoring are carried out by analysing the intensity of radio signals obtained by mobile devices from beacons located on opposite sides of the lane [14].
- This paper proposes a traffic congestion management system for drivers that involves data collection, segmented structure formation, traffic-flow modelling, local segment traffic congestion prediction, and origin-destination traffic congestion service [15].
- This paper proposes a real-time traffic control system for vehicle identification and tracking in dimly lit situations, which discusses some of the European Union's road safety indicators. Low lighting, light spots, shadows, light reflections, and other effects can be seen on many urban and extra-urban roads or tunnels at night. The proposed system's key goals are to: (a) track traffic flow, (b) estimate vehicle speed or assess the condition of traffic, and (c) identify anomalous conditions, such as rising alarms in the event of road accidents or stopped vehicles [16].

 doi:10.20944/preprints202203.0141.v1

- The focus of this study was on traffic and the use of UAV cameras to extract traffic data. Our first objective was to develop an automated system for counting vehicles using traffic cameras. Strong routing protocol is a need for a healthy network [17]. We used the Background Subtraction Method (BSM) and the OverFeat Framework to achieve this aim. To detect moving objects, BSM compares consecutive frames. Since BSM only works in ideal lab conditions, we developed the OverFeat Architecture, a Convolutional Neural Network (CNN)-based classification algorithm. To count the number of passing vehicles, we built different segments on the road in various lanes. Regardless of varying visibility conditions during the day and night, we were able to count cars with 96.55 percent accuracy [18].

(device)

 doi:10.20944/preprints202203.0141.v1

(adapter)

FUNCTIONAL REQUIREMENTS

Vibration sensor: Vibration sensor is a device that provides the values of shocks absorbed by the device. It is the device that changes its resistance value when the device detects the shocks or vibrations.

Node MCU: It is used in the system to read inputs and outputs. In our case Node MCU is a better option than Arduino [19] because the product designed was to make sure that it remain as portable as possible.

 doi:10.20944/preprints202203.0141.v1

Buck Converter: The Buck converter is a dc to dc voltage converter. The voltage regulator IC is used to step down and regulate higher level dc voltage values to lower voltage levels.

GPS Module: GPS module is one of the very important components of this project. GPS module has got a high-efficiency receiver. This GPS module has a small battery and EEPROM.

 doi:10.20944/preprints202203.0141.v1

Potentiometer: A potentiometer is a type of position sensor. They are used to measure displacement in any direction. Linear potentiometers linearly measure displacement and rotary potentiometers measure rotational displacement.

NON-FUNCTIONAL REQUIREMENTS

Response time: The route monitoring system got a great response time.

Throughput: Entire system has managed to work properly and it sends the data to the relevant slave device in time, and the communication between the devices is commendable to produce output with reliability.

Execution time: Execution time is sometimes split second or 1 second i.e. the calculations and operations are performed accurately and in short time.

Project Access: System access should be available to the authorized people only.

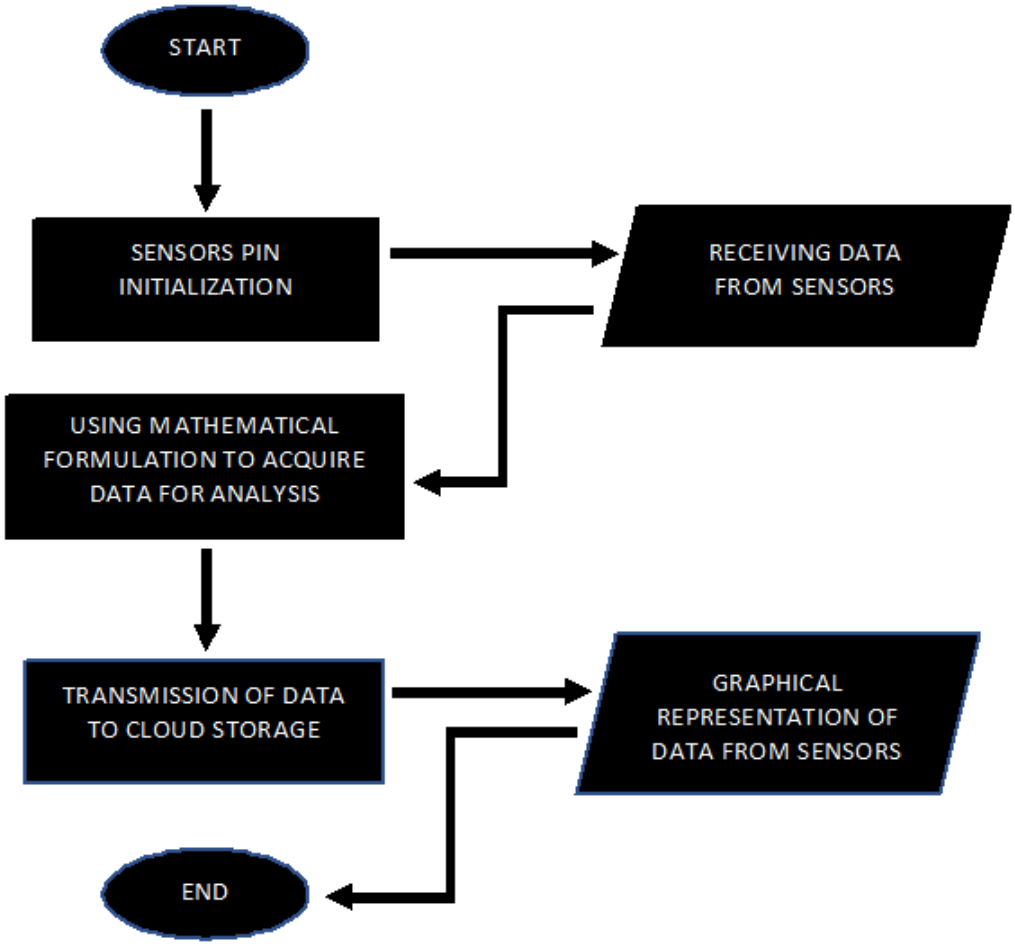
Data availability: Customer's saved at the portal for future access should be stored in a manner that the data should be kept private.

3. METHODOLOGY

3.1. Proposed Work

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 March 2022 doi:10.20944/preprints202203.0141.v1

The proposed work is to create a low budget system that will help in solving the problem of people according to the conditions. In rural and urban areas both the people face time-wasting and in some cases loss of their goods during the transit. Accordingly, a smart, fast, and real-time data collection system is designed to provide the data to the relevant authorities of the government and helping them overcome this massively important issue.



3.2. Brainstorming

The conventional brainstorming process began with the collective participation of all of the group members over all the areas. Different options were explored from the fundamentals and various strategies were discussed to evaluate each step before its implementation. Following are the strategies that ensured healthy debatable points:

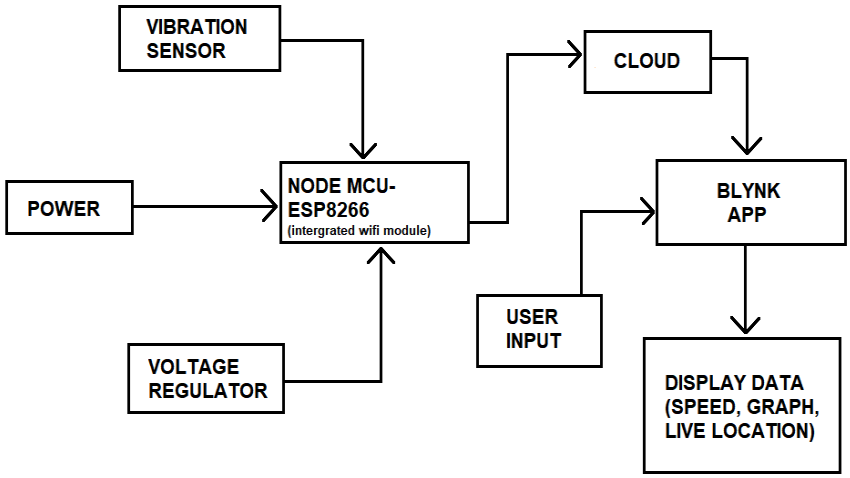
- Strategies over controlling the positioning of the GPS sensor on the system.
- Strategies over controlling the position of Vibration sensor.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 10 March 2022 doi:10.20944/preprints202203.0141.v1

- The components be placed to keep the system as portable as possible.
- Sensors and their reliability was one main topic.
- Corroboration in making the system entirely waterproof.
- GPS acutely guiding the parallel roads.
- Data to be transmitted to the cloud in Real-time.
- Cost estimation. Making sure that the product is cost-effective.

3.3. System Designed

- Technologies to be deployed must be employed in a way that is easy to use.
- Alternative options and their consideration was made to check for design depth.
- Microcontroller used is working at the same time as the Wi-Fi module ensuring cost-effective.
- Debugging, testing, and troubleshooting the system and its functions over time.
- Deployment in a real-world environment to ensure system reliability..



3.4. Novelty

- Low cost and portability of the system.
- Data collection that can be supplied to authorities.
- Real-time data movement.
- Ensuring the data is easily accessible from the cloud server.

4. RESULT ANALYSIS

The project was worked and completed within the time. The integration of hardware components including the circuit designing was first completed on the in the proteus software. The simulations were checked before. The working of the hardware components which includes the proper GPS sensor positioning and tracking of the device in which the application is opened. Initially, there were problems faced by the working team regarding the improper tracking. However, after troubleshooting multiple times the problem was resolved and project was depicting correct and on time data can be received. After the completion of the project the observations were prompting that vehicle traveling can be tracked through the map, application was displaying the sharp spikes in real time. Moreover, through the screen recording procedure the data can be saved and it was uploaded to the cloud server i.e. blynk platform. Hence, the subject of providing the roads' data can be shared with the regulatory body of government.

5. CONCLUSION

The project was designed to perform the operations of monitoring and recording the data to a blynka platform. Therefore, it can be said that the project was able to perform well when tested. Albeit, there were expected times and the group did face some issues during its completion. Issues regarding the improper signal catching of WIFI, etc. However, those issues were solved by timely troubleshooting. The problem people faced of the improper and in some cases poor conditions of the roads resulting in the loss of the people can now be mitigated to a larger extent, goods can be sent to the destinations quicker than before by choosing the right tracks for the travel. Late works caused by the roads' conditions can now be solved both in rural and urban areas. Besides, the data collection would be provided to the regulatory bodies to help solve the roads' maintenance issue without tracing every street. Instead, they would just check the platform setup i.e. blynk and from there data can be retrieved.

REFERENCES

1. Q. Shi and M. Abdel-Aty, "Big Data applications in real-time traffic operation and safety monitoring and improvement on urban expressways," *Transp. Res. Part C Emerg. Technol.*, vol. 58, pp. 380–394, 2015, doi: 10.1016/j.trc.2015.02.022.
2. E. Lee, E. K. Lee, M. Gerla, and S. Y. Oh, "Vehicular cloud networking: Architecture and design principles," *IEEE Commun. Mag.*, vol. 52, no. 2, pp. 148–155, 2014, doi: 10.1109/MCOM.2014.6736756.
3. M. A. Kamal, M. M. Alam, H. Khawar, and M. S. Mazliham, "Play and Learn Case Study on Learning Abilities through Effective Computing in Games," *MACS 2019 - 13th Int. Conf. Math. Actuar. Sci. Comput. Sci. Stat. Proc.*, pp. 1–6, 2019, doi: 10.1109/MACS48846.2019.9024771.
4. B. V. S. Padmaja, V. R. Kolluru, and S. S. Kota, "IoT based implementation of vehicle monitoring and tracking system using node MCU," *Int. J. Innov. Technol. Explor. Eng.*, vol. 8, no. 6, pp. 446–450, 2019.

5. B. Syed, K. Srinivasarengan, A. Pal, and P. Balamuralidhar, "Systems®: Road Surface Monitoring with mobile," pp. 8–12, 2012.
6. V. Douangphachanh and H. Oneyama, "A study on the use of smartphones under realistic settings to estimate road roughness condition," *Eurasip J. Wirel. Commun. Netw.*, vol. 2014, no. 1, pp. 1–11, 2014, doi: 10.1186/1687-1499-2014-114.
7. M. A. Kamal, M. Alam, M. S. Mazliham, and H. W. Raza, "A Review of Middleware Platforms in Internet of," no. April, 2021.
8. A. Ghose, P. Biswas, C. Bhaumik, M. Sharma, A. Pal, and A. Jha, "Road condition monitoring and alert application: Using in-vehicle smartphone as internet-connected sensor," *2012 IEEE Int. Conf. Pervasive Comput. Commun. Work. PERCOM Work. 2012*, no. March, pp. 489–491, 2012, doi: 10.1109/PerComW.2012.6197543.
9. M. A. Kamal, H. W. Raza, M. M. Alam, and M. Mohd, "Highlight the Features of AWS, GCP and Microsoft Azure that Have an Impact when Choosing a Cloud Service Provider," *Int. J. Recent Technol. Eng.*, vol. 8, no. 5, pp. 4124–4232, 2020, doi: 10.35940/ijrte.d8573.018520.
10. M. Sarrab, S. Pulparambil, and M. Awadalla, "Development of an IoT based real-time traffic monitoring system for city governance," *Glob. Transitions*, vol. 2, pp. 230–245, 2020, doi: 10.1016/j.glt.2020.09.004.
11. R. Aissaoui, H. Menouar, A. Dhraief, F. Filali, A. Belghith, and A. Abu-Dayya, "Advanced real-time traffic monitoring system based on V2X communications," *2014 IEEE Int. Conf. Commun. ICC 2014*, pp. 2713–2718, 2014, doi: 10.1109/ICC.2014.6883734.
12. M. A. Ameddah, B. Das, and J. Almhana, "Cloud-Assisted Real-Time Road Condition Monitoring System for Vehicles," *2018 IEEE Glob. Commun. Conf. GLOBECOM 2018 - Proc.*, pp. 1–6, 2018, doi: 10.1109/GLOCOM.2018.8647334.
13. P. Figueiras, Z. Herga, G. Guerreiro, A. Rosa, R. Costa, and R. Jardim-Goncalves, "Real-Time Monitoring of Road Traffic Using Data Stream Mining," *2018 IEEE Int. Conf. Eng. Technol. Innov. ICE/ITMC 2018 - Proc.*, 2018, doi: 10.1109/ICE.2018.8436271.
14. M. Lewandowski, B. Płaczek, M. Bernas, and P. Szymała, "Road traffic monitoring system based on mobile devices and bluetooth low energy beacons," *Wirel. Commun. Mob. Comput.*, vol. 2018, 2018, doi: 10.1155/2018/3251598.
15. D. B. Nguyen, C. R. Dow, and S. F. Hwang, "An Efficient Traffic Congestion Monitoring System on Internet of Vehicles," *Wirel. Commun. Mob. Comput.*, vol. 2018, 2018, doi: 10.1155/2018/9136813.
16. G. L. Foresti and L. Snidaro, "Vehicle detection and tracking for traffic monitoring," *Lect. Notes Comput. Sci. (including Subser. Lect. Notes Artif. Intell. Lect. Notes Bioinformatics)*, vol. 3617 LNCS, pp. 1198–1205, 2005, doi: 10.1007/11553595_147.
17. M. A. Kamal, M. M. Alam, and M. S. Mazliham, "Routers Perspective Simulation-Based Analysis of EIGRP and OSPF Routing Protocol for an Organizational Model," *Int. J. Innov. Technol. Explor. Eng.*, vol. 9, no. 4, pp. 2013–2019, 2020, doi: 10.35940/ijitee.b6509.029420.
18. L. Muscalu, P. A. Smiley, and D. Ph, "A dissertation submitted to the Faculty of Claremont Graduate," no. May, pp. 1–24, 2007.
19. M. A. Kamal and M. Maknojia, "Camera With live Streaming," vol. 13, no. May 2019, pp. 6–9, 2020.