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## Abstract

Nowadays instruments installed on vehicles have been widely used to detect road conditions. However, roads that are too narrow cannot be detected by cars or trucks, then the idea of building instruments for bikes emerges. Our capstone project is to build an instrument that can be installed on a bike, which is used to detect real-time conditions of infrastructure systems. Regarding the hardware, we use Raspberry Pi 3B+ model as our microcontroller, which is responsible for collecting raw data like pictures, positions, and acceleration about infrastructure systems, then analyze these data to help decision makers for improving the efficiency and ubiquitous use of bicycle mobility. As for the software system, we develop Android Apps of smartphones and watches for users to view the road conditions conveniently. The research of the instrumented bike is an innovative field, and our project combines novel technologies, such as disputed computing, machine learning and the Internet of Things.

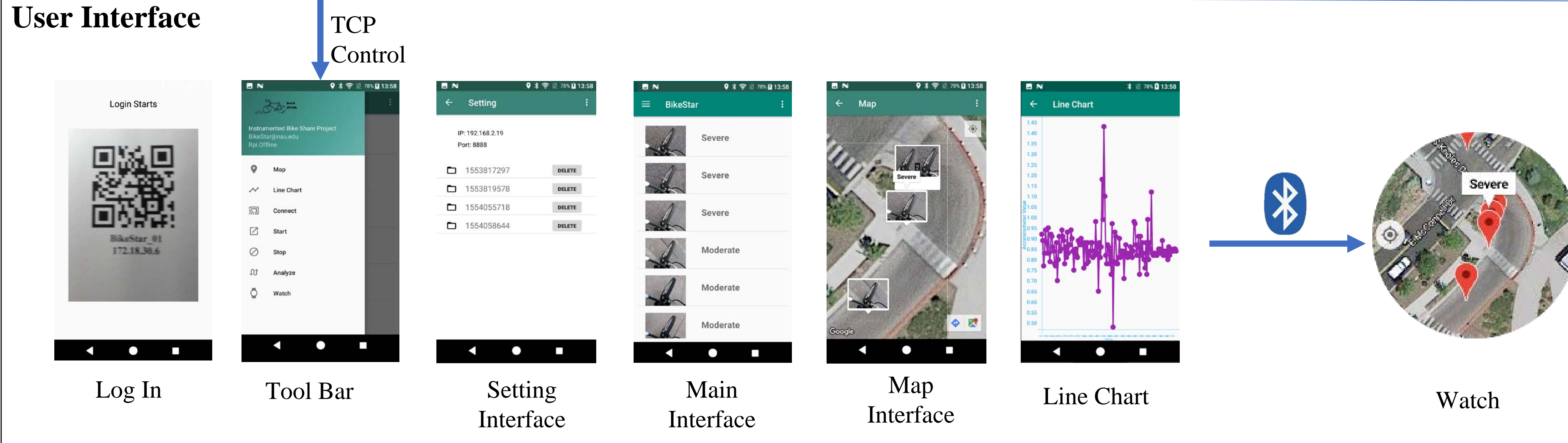
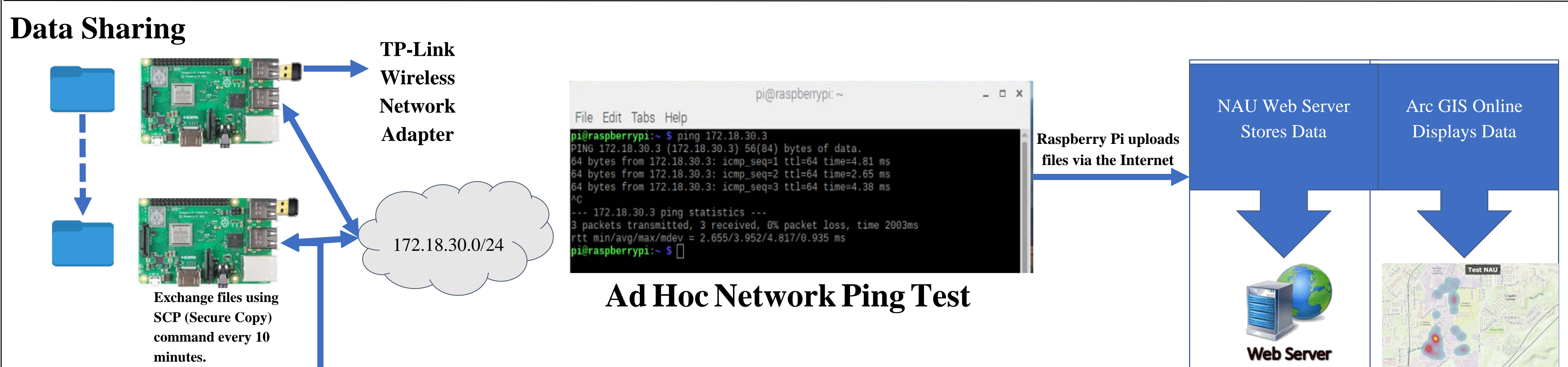
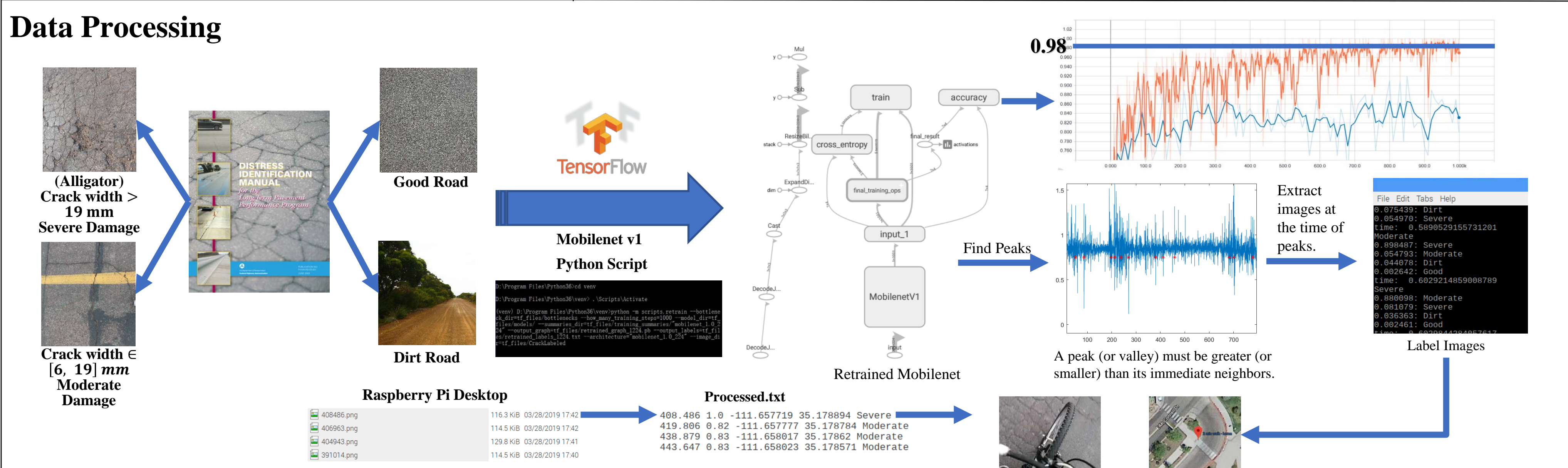
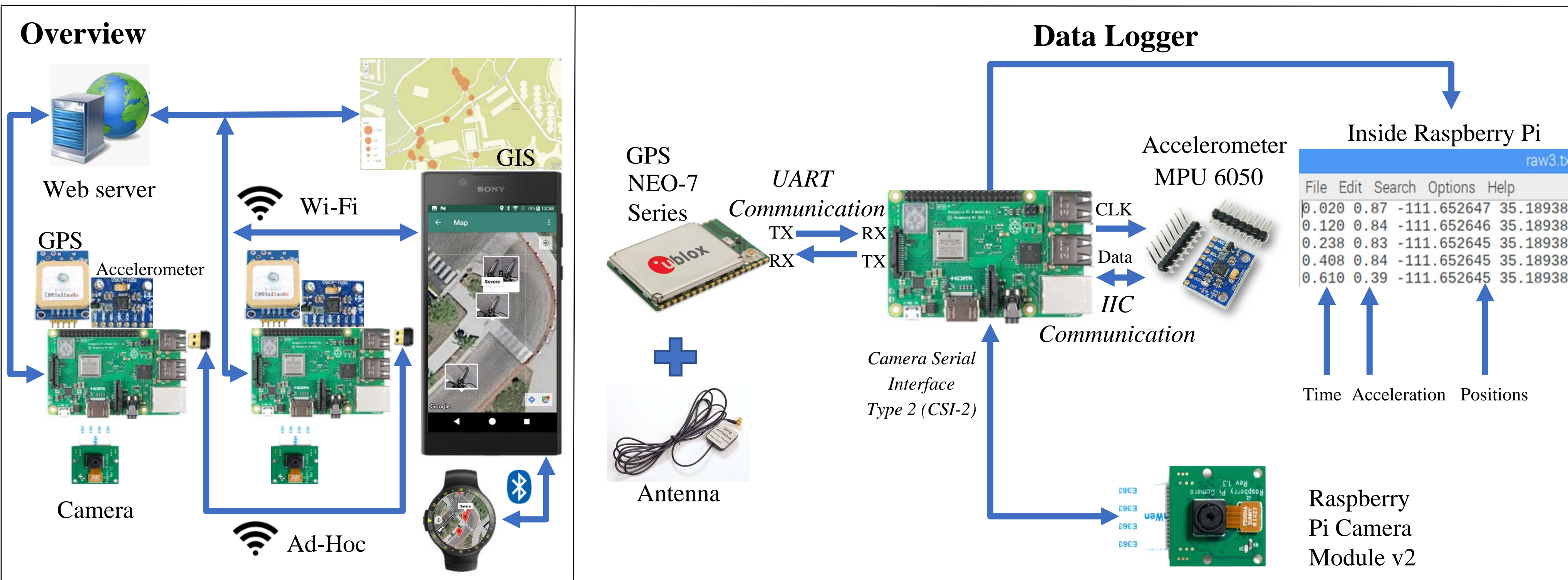
## Methods

- Python programming for machine learning.
- Android programming for phone and watch APP.
- Transfer learning for neural network training.
- TensorFlow for speeding up float points calculation with deep learning on embedded systems.
- Raspberry Pi 3B+ for collecting and sharing data.
- Serial communication between the microcontroller and GPS.
- IIC Communication between the microcontroller and accelerometer.
- FTP for transferring files from the Raspberry Pi to the smartphone.
- TCP for the phone controlling the Raspberry Pi.
- GIS (Geographical Information System) for showing road conditions online.
- Ad Hoc network for sharing data locally.

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## Results



### Why do we do this project?

Traditional Road Detection Car

- Expensive
- Huge weight
- Limited to motor road

Our Design

- Light Weight
- Small Volume
- Low Cost
- Apply to Any Road

## Conclusion

Conclusively, our instrumented bike share system can be an alternative choice of the existing asphalt road detection vehicle. Although the accuracy of our system may not surpass the existing detection device, our system is more advantageous in cost, weight, and volume. Also, all the techniques stated in this project, including the artificial intelligence (Deep Learning), data sharing through a network as well as all the hardware components are involved in the cutting edge pieces of ICT (Information Communication Technology).

## Acknowledgements

We would like to thank Dr. Chun-Hsing Ho for his sponsorship for our project and giving us the opportunity to improve our professional skills throughout this challenging project. Also, we thank Dr. Kyle Winfree for his technical help, sponsorship and directing us to the right way of the capstone project. Besides, we appreciate that the team members of Instrumented Bike Share capstone project of 2018 provided us with advice and encouragement.

As developers, we are thankful that Github open source community, as well as Stack Overflow and Raspberry Pi Forums, helped us solve coding issues.

Last but not least, we appreciate to be one of the NAU-CQUPT 3+1 program students and we experienced the most wonderful year in NAU and in the United States.