Product Interview Reflection Paper

**Class:** CS-598

**Team Name:** PiPeWan

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**Project Name:** Pipe monitoring system using LoRaWan

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**Introduction**

Colder weather means that there is a chance for pipes to burst, this is because the water inside of pipes will freeze, expanding and causing the pipes to break. For building owners' damaged pipes mean damage to their building and damage to their wallet. Our system aims at fixing this issue by sending out a warning to building owners when their pipes are at risk of freezing. During the first week of November our team interviewed co-workers, building managers, and other people about our system. Some of the questions we asked include questions about our project's relevance, functionality, our price point, the looks and design of the system, and the sustainability of our project.

**Body**

**Interview 1:** Garrett Riedesel

Garrett is a student at Wichita State University and co-worker of Aron and Alex at NIAR, the National Institute of Aviation Research, in the Robotics and Automation lab. He was affected by broken pipes in the John Bardo Center last winter when the pipes above the robotics and automation lab broke. The pipe bursting caused some damage to the building and damage to the lab. There are many expensive robots, upwards of $100,000, in the lab. Needless to say, water damage poses a huge risk to his workplace. After explaining our project to Garrett, he said it seems like a clever idea and something that would be of use. In particular, he believes the price point per-unit to be very economical. Garrett said our project is relevant for building owners who do not have heated or properly insulated pipes.

Garret raised an insightful proposal and concern. He suggested that in addition to temperature and flow we also measure the pressure of the pipes. One of the issues with sustainability that Garrett had is the battery that we are going to use. He was worried about how long it would last and how often it would need to be charged. Overall, Garrett liked our product idea and only had a few concerns with it.

**Interview 2:** Robert Evans

Robert is a full-time staff member at NIAR in the Robotics and Automation lab, and he was also affected by the broken pipe in the JBC. He holds a bachelors in electrical engineering and before that he worked as a student for NIAR for three years. Our interview with him was the longest of the three and he had many recommendations and concerns. Even so, He believes our project has potential and marketability.

Robert did his best to unearth any potential issues with our project; One being the jurisdiction where we choose to apply our system. He advised we be aware that there is a limit at which the state become responsible for maintaining pipes. We also need to be aware of how much we can do beyond WSU. Since WSU has its own water sources, it is relatively simple to gain permission and access to pipes; However, This could change outside campus. Another limiting factor is the type of pipe that our system works on. Since metal has a higher thermal conductivity than PVC, the temperature readings from metal will more accurately reflect the temperature of the water inside. He recommended we test how affectively we can estimate the temperature inside a PVC pipe. Robert also suggested that we consider the diameter of pipes that we are installing our nodes on. Specifically, the JBC has pipes vary from eight wide inches all the way down to one inch in some parts of the building.

Robert had some suggestions about our physical design including: the housing, the power, and additional features. Robert said that we need to make sure our device is waterproof since we are attaching an electrical device to a water pipe. For this, Robert suggested designing the enclosure with a groove for an O-ring or silicone and printing it with a filament with low water permeability. He suggested using a two-way relay so we can have two batteries powering our node in case one of runs out of power. The relay will act as a switch between the two batteries and it’s only a mitigation in the unlikely case we lose our primary power. For the future of our project, Robert suggested implementing a mechanism to close off a pipe if its readings are trending towards failure. We expressed a bit of concern about the level of authority we have to actually command pipe shutdown, but Robert said it should not be a problem as such extreme measures will require a manual shutdown anyway. In case our project goes smoothly and we have time to spare, we will consider developing a solution to automatically shut down pipes.

**Interview 3:** Debra Franklin

Debra is the Vice President for the John Bardo Center and so knows a great deal about the facilities there. She is very familiar with frozen pipe issues throughout the building; so much so that in the short time we spoke, she referenced four separate flooding incidents. She explained that the fire sprinkler system in the south entrance to the JBC has frozen and subsequently burst three times in recent years. The flooding has been so prevalent and damaging that they had no choice but to shut off water flowing to that part of the building. Perplexingly, the north entrance, which is an exact copy except shaded from the sun, has never frozen or flooded. She was very interested to learn why this is the case and what can be done to prevent the south entrance from flooding in the future.

Our next stop was a maintenance room on the third floor of the JBC. Last December, a pipe there froze and burst open over the weekend. The result was flooding of the roof, third, second, and first floors. It was lucky anyone was there who could act quickly to shut off the water. She expressed concern that the insulation surrounding the new pipe may not be enough and flooding may occur again. Due to time constraints on her part, we were unable to visit other parts of the building, however she did reference issues with pipes in the basement that she hoped could be addressed as well.

Debra’s view of the project was practical, optimistic, and cooperative. It is clear after meeting with her that there is a real need and opportunity for PipeWan to help prevent property damage due to flooding.

**Conclusion**

Firstly, from everyone we interviewed it was apparent that they believe that our product is useful and will help building owners protect their building. From interviewing Garrett, Robert, and Debbie, everyone believes that our nodes will be able to effectively monitor information about pipes and warn the building owners. They believe that our product is marketable and building owners will be willing to buy our product. They were also very helpful in pointing out how we can improve our approach and reconsider some of our initial plans. Their valuable input gave us a much clearer picture of the design and testing methods we will use to make the product better.