Online Data Collection and Monitoring in Cyber Manufacturing

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Abstract

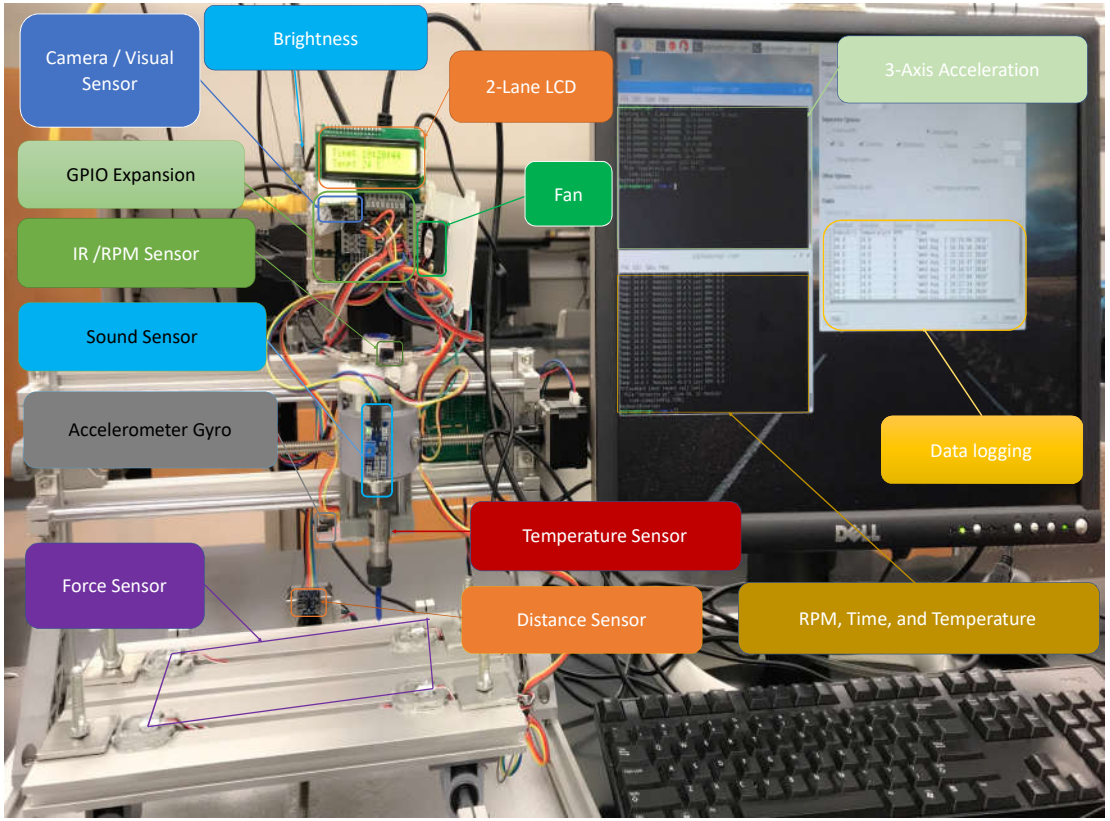
- Develop a system that helps in cross-communication between CNC's and human beings.
- CNC's are machines often used in custom manufacturing.
- Due to processing complexity and value of product, quality and efficiency are major factors of custom manufacturing.
- Hence, an online data collection and monitoring in machining customized product is important to adjust production or develop a closed-loop feedback control.
- Contactless sensors such as speed, force, distance, sound, temperature and camera are placed around the CNC machine to collect signals, then wired to a controller for processing. Subsequently, processed data is transmitted to data cloud, where offline managers and researchers could make more effective decisions.

Materials Used

- 3018 DIY GRBL CNC machine
- Adafruit Sensors (speed, force, temperature, camera, sound, distance and RPM)
- Raspberry Pi 3B, SD card
- Connectors (GPIO, Head pin, Ethernet, and HDMI
- Tools and equipment (glue gun, soldering iron, keyboard, monitor and mouse)
- Programs, apps and software (Python, Terminus, AnyConnect, and Noobs)
- Instrument (voltmeter)

Results

A data and acquisition system was developed to obtain process data from a CNC machine.



Architectural Design

Figure 1[1]: CNC Machine

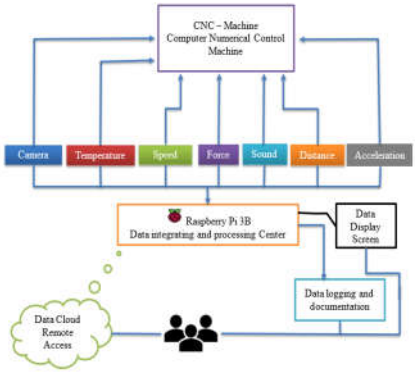


Figure 2: data and acquisition system architecture

Conclusion

During this research, a sensor system which incorporates online monitoring, data collection, remote accessing, documenting and forecasting using affordable signal detectors was built. Sensors were secured around the CNC machine, then wired to the Raspberry Pi for further processing. Processed data was transmitted to the cloud, then accessed by offline managers and researchers to make quality and efficiency changes in real time.

The next stage in this research is to replace and calibrate inaccurate sensors with small range sensors. In addition, researchers will develop a closed-loop feedback control to the system and implement proper cyber control to the loop against security breaches.

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