

Voice Controlled Injector

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Abstract

During endoscopic procedures, it can be difficult for doctors to operate an endoscope while also communicating with a technician who is injecting a dye at the site via syringe. Excess volumes of this dye can lead to pancreatitis within the patient. The proposed project was to create a syringe injector that could be activated by traditional manual controls or by the user's voice. Voice control would have the same functionality as manual, being able to change volume and rate of the injected fluid while also being able to start or stop the injection. Once powered on, the user could interact with the device hands-free.

Introduction

We needed to design a device that will...

- Respond accurately to voice commands
- Inject exact amount of fluid at steady flow
- Work with a standard 12cc syringe
- Have manual controls that can work in tandem with voice controls
- Be a standalone unit powered by battery



Figure 1: Two handed endoscopic surgery

Methods and Materials

A Raspberry Pi was used to control a Nema 17 stepper motor with a 3-D printed mount for the syringe. A manual interface is included to override voice commands and display current volume and flow rate settings along with device status.

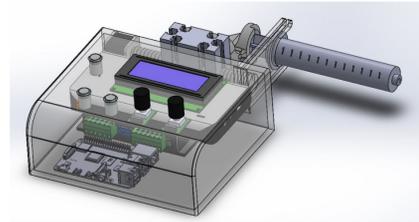


Figure 3: Design with shell

Voice activation utilized Rhasspy for speech recognition and getting the intent of the user. Programming for commands were written in Node-Red using the programming language of JSON.

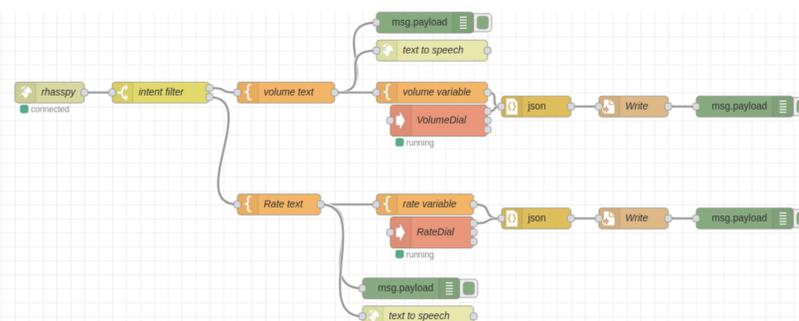


Figure 4: Node-Red Diagram

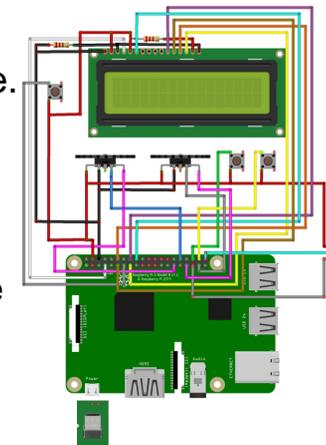


Figure 2: Wiring Diagram

Discussion/Results

Both voice activation and manual control alter the same speed and volume variables while updating settings on screen with no noticeable delay. Motor code accesses variables and moves accordingly.



Figure 5: Displaying data from text file

Conclusions

Before, medical practitioners would need an extra set of hands to interact with a syringe injector while they were already holding other tools. This device utilizes voice recognition for hands-free control, allowing for easy and direct interaction while also potentially requiring one less person in the room.

Acknowledgements

We would like to thank Hasan Ferdowsi, Simon Kudernatsch, and Justyna Kielar for their guidance in this project. We would also like to thank Northern Illinois University for the tools provided and their flexibility in allowing us to work from home.