

# Accelerometer in Epley Manoeuvre Treatment for Benign Paroxysmal Positional Vertigo using Arduino Pro-Mini 328

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**Abstract:** Benign Paroxysmal Positional Vertigo (BPPV) is a spinning sensation as if the space or surrounding environment is spinning in circles around the person. Some techniques include using photos and videos to help individuals through the procedure, but it is also necessary to overcome the uncertainty that comes with shifting the head from a specific position. This movement tracking was built around an Arduino microcontroller for rapid development and prototyping. The microcontroller performs three important tasks: position computations based on inertial measurement unit (IMU) data, instructing the user on how to adjust their body, and ensuring that motions are executed correctly. This project may enable a doctor or a patient to easily cure BPPV. Doctors are unable to treat BPPV patients with medication since the illness is similar to a headache. The Epley Manoeuvre is a therapy for BPPV that might gradually decrease the condition. Most patients are relieved that their condition may be quickly resolved with the help of a health care practitioner who is well-versed in the diagnosis and treatment of BPPV, allowing their world to stop spinning. This project can make a significant improvement using the technology that is now being developed at the forefront of innovation, and it will be practical and, hopefully, result in a decent product.

**Keywords:** BPPV, Epley Manoeuvre, Vertigo

## 1. Introduction

Benign Paroxysmal Positional Vertigo (BPPV) is a feeling of dizziness spinning, as if the space or surrounding world is spinning around the person in circles. The word is used by many people to describe a fear of heights, but this is not true [1]. When a person looks down from a great height, vertigo may occur, but it typically refers to any acute or continuing spells of dizziness that occur due to inner ear or brain issues. It is a symptom, not a disease. Vertigo can be triggered by several different factors. An individual with vertigo will feel as though they are shifting or turning their head or the space around them. Vertigo is a symptom, but alongside other symptoms, it may contribute to or occur too [2]-[3].

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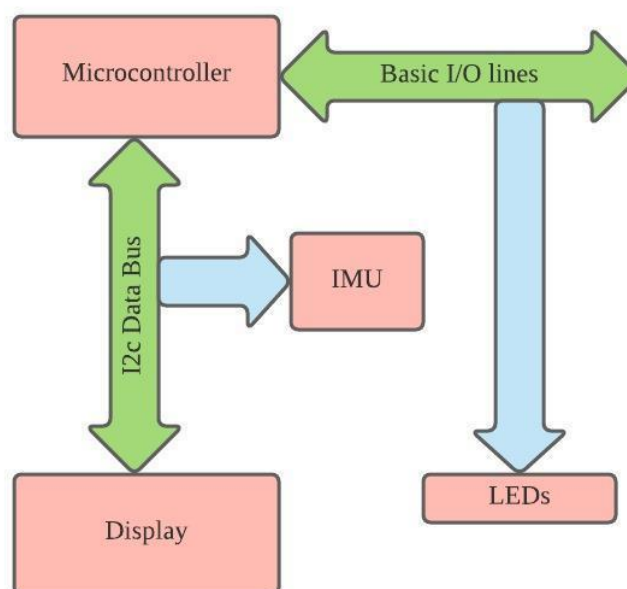
This may include balance concerns, bewilderment, a feeling of illness in motion, sickness and vomiting, ear ringing, called tinnitus, the sense of fullness in the ear, headaches and nystagmus which is the eyes move uncontrollably, normally from side to side.

The Epley maneuver is one maneuver which is used for the most common position and type of BPPV. That will not fit for all BPPV presentations, however. People have also attempted the Epley maneuver on their own or had it done without success on them. Subsequent evaluation indicates that it is actually a particular approach that should have been used, or that it is not BPPV at all. Therefore, self-treatment or treatment by someone who is not thoroughly qualified in the recognition of the several different variants of BPPV and associated treatment maneuvers should be used with caution. In addition, the healthcare provider should conduct a thorough neurological scan, assessment of the neck, and other safety-related investigations before checking or treating for BPPV to decide if any elements of the procedure need to be changed or prevented. This is another good argument for a minimally qualified healthcare provider to be skeptical about self-treatment or treatment [4]-[5].

A disorder affecting 8 million Americans and one in four people over 65 years of age. BPPV, shortened for Benign Paroxysmal Positional Vertigo, is a condition that causes symptoms such as dizziness, loss of balance, nausea, and perception of the spinning world. Unfortunately, care is very difficult to obtain, since non-specialist doctors would opt not to conduct the exercise because they feel it will cause more damage to the patient if it is performed wrong. The lack of experience and the level of difficulty in performing maneuvers prevents people with vertigo from accessing care that is more available. At present, patients in the United States may need to drive for several hours to meet a vestibular specialist to have the Epley maneuver performed to alleviate their symptoms.

## 2. Materials and Methods

The simplified movement monitoring block diagram is shown in Figure 1. For quick development and prototyping, this movement tracking was based around an Arduino microcontroller. Three key tasks are performed by the microcontroller; perform position calculations based on inertial measurement unit (IMU) data; instruct the user how to shift their body and ensure that movements are performed correctly.



**Figure 1: Simplified Movement Block Diagram**

For quick development and prototyping, this movement tracking was based around an Arduino microcontroller. Three main tasks are performed by the microcontroller: performing position calculations based on inertial measurement unit (IMU) data, instructing the user how to move their body, and ensuring that movements are properly carried out. After the user chooses the ear in which the issue is located, the software steps through the user's movements very literally. The software checks the following parameters during each stage, primarily concerning the chin tilt, neck rotation, and side to side tilt of the head of a consumer. In addition, to ensure that movements are not carried out too slowly or rapidly, it also tests rotational speeds.

Each phase has a specific set of parameters to be reviewed in order to ensure that proper movement has been carried out, hence the nature of the state machine based programmed. The curriculum continues to the next stage after all the conditions are met. If the conditions are not met, or the computer takes measurements that should not be identified in the current motion, the program returns to the first instruction and warns the user to restart the program.

Figure 2 demonstrates the process for the project and represents it in the form of a flow chart. A lot of information collection activities are carried out in the earlier stage, consisting of a lot of relevant information for this project. This project began by analysing previous work to gain an understanding of the fundamental principle of the line. To follow the robot and to gain an understanding of the progress made so far in the project.

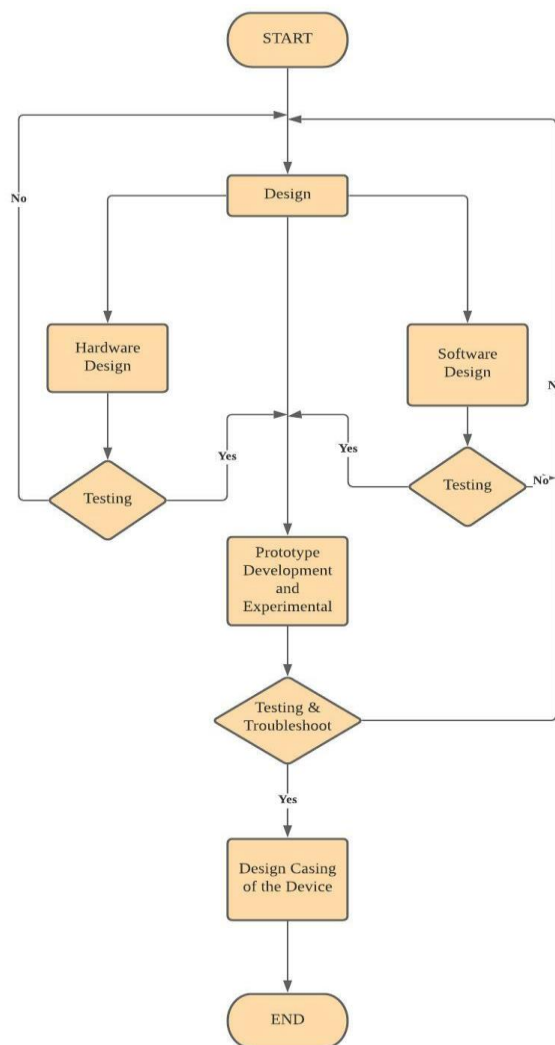


Figure 2: Flow Chart

The hardware used in this project is Arduino Pro Mini 328, GY-85 IMU 9DOF sensor and LCD display 20x4 only as shown in Figure 3. This hardware used to accelerate degree of head when use to apply Epley manoeuvre.

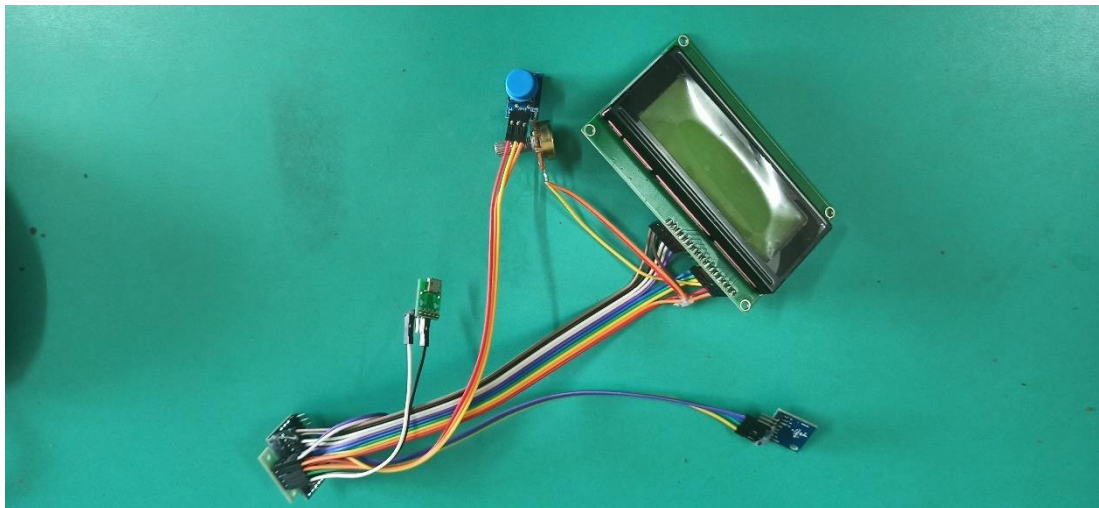


**Figure 3: Block diagram of project**

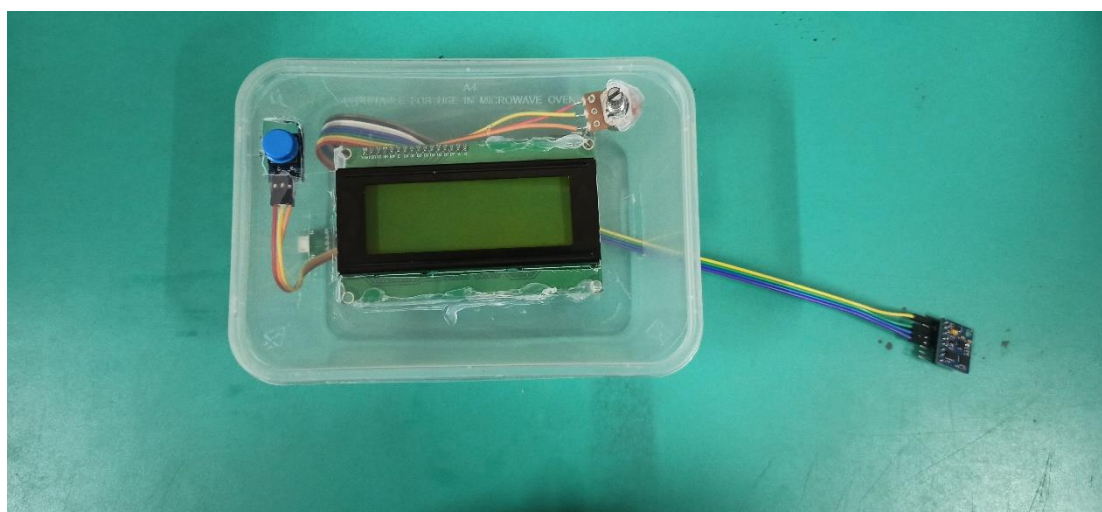
### 3. Results

For the result, after do some troubleshoot at coding and prototype, Figure 4 and Figure 5 show the project with and without casing.

For image in Figure 4 shows the project without any casing. The connection of this project as we can see power supply connected too Arduino and IMU sensors. Beside three main components, this project also use a several components such as push button and toggle switch.



**Figure 4: Without Casing**



**Figure 5: With Casing**

Each component has its own function likewise push button, its function when that button has been pushed, the display will show the reading of head angle. Function of toggle switch just to adjust the brightness of display.

### 3.1 Result Outcome

This project can help some doctor or maybe the patient itself to treat BPPV easily. To treat BPPV, the doctors cannot give medicine to the patients because this disease like another headache. For BPPV, there are some treatment that can reduce the disease slowly which is called Epley Manoeuvre.

This treatment starts with on the right side. Firstly, the patients sitting on a bed and turning their head 45 degrees to the right. Place a pillow behind them so that it is under your shoulders when you lie back [6]. This shown in Figure 6 and for Figure 7 shows the degree at the aid.



**Figure 6: Patient sit with head turns 45° to right**



**Figure 7: 45° reading**

Next step is the patients have to lie back quickly on the pillow with shoulders and head lying on the bed. Wait 30 seconds. This shown in Figure 8.





**Figure 8: Patient quickly lie on pillow**

After that, turn left (without raising) on the patients head 90°, then wait for another 30 seconds. This shown in Figure 9. For the Figure 10 shows the degree of the turn of the patient's head.



**Figure 9: Patient's head turn 90° to left**



**Figure 10: 90° reading**

Lastly, for the right side, turn the body of the patient and head for another 90° to the left and wait 30 seconds. This shown in Figure 11 and Figure 12 for its degree.



**Figure 11: Patient turn their head and body 90° to left**



**Figure 12: 90° reading**

After the patients settle for the right side, they can sit up on the left side and rest for couple of minutes before begin the left side. After that, patients do the same step like Figure 6 to Figure 12 for another side, left side.

#### **4. Discussion**

For this project, there are still have slack for the sensor which is that sensor still cannot get the exact value. The reason for this lack, the sensor must have to adjust at the right place to get the stable value of zero degree for the start of manoeuvre. This will be the relative error for this project because the writer cannot get the right equation for the stable starter zero degree because of the time constraint and got a several of technical issue during the completion of project.

#### **5. Conclusion**

In conclusion, BPPV is a general problem, and more and more will be faced as our population ages. The effect may vary from a mild irritation to a very debilitating illness, and can affect work, protection, and risk of falling. Fortunately, when the brain increasingly responds to the irregular signals it receives,

or because the disorder spontaneously recovers, symptoms begin to decline with time. However, most patients are happy that their problem can be easily corrected with a health care provider who is well qualified in the diagnosis and treatment of BPPV so that their world can stop spinning.

### Acknowledgement

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