Project Title: VeloS-Band

Team Members (Names, Roles, BS/MS, Major):

1. Marco Gallardo, MS, Computer Engineering

2. Kevin Lewis, MS, Computer Engineering

3. Andy Liu, MS, Computer Engineering

4. Blas Arras, MS, Computer Engineering

Date Submitted: 2/10/26

1. Project Overview (Short Summary)

Provide a brief description of your project idea (2–5 sentences).

- What are you building?

Our team is building a wearable device that allows for the user to calculate the speed in which their hand swings for usage in a multitude of sports. Sports that could benefit from this technology include: bowling, baseball, disc golf, golf. For the context of this project we will look at bowling and accomplish building a wearable device that will accurately display and log the speed at which the user throws the bowling ball at the point of release. In addition to the wearable, we will also design a software component that helps display and log the data that is recorded using our wearable.

- Is it hardware, software, or hybrid?

Hybrid, hardware that is worn, software to calculate and display results.

2. Problem Statement and Motivation

Clearly describe the problem your project addresses. Write this passage targeted for a general audience who may not necessarily have a technical background.

- What real-world need does this project solve?

In the sport of bowling, the speed that is projected to the bowler is often not the speed that is relevant to the user. Speed on most modern scoring systems are calculated using the speed of the ball between 45-60 feet down the lane, a distance in which the ball has

likely already experienced external forces that change both speed and direction. Our project helps aim to solve this problem with a much easier and cheaper alternative to current technology by tracking the initial velocity applied.

- Who benefits from this solution?

Athletes and Coaches, this product will allow for users to accurately track the information that is important to the bowler, without having to invest into super expensive technology or have to rely on complex calculations.

- Why is this problem important?

There is no easily accessible or usable solution to being able to accurately calculate the speed at release at the moment. Specto, one of the current technologies that uses camera technology to calculate the speed we are trying to calculate, is well over $10k in price, and the alternative method of using a camera is also unreliable due to the likelihood of user error from counting frames and varying framerates, as well as the overall extra wasted time it takes to accomplish. Our product aims to provide a simple solution to this problem in the form of a wearable.

3. Proposed Solution / Technical Approach

Describe your planned system design at a high level. Graphical abstracts are optional at this stage.
Discuss expected components such as:

- We're using an inertial measurement unit sensor that collects motion data and uses that information to show how fast someone's swing was.
- Expected components:
  9-axis IMU: main motion detection sensor
  Seed Studio XIAO: small microcontroller with bluetooth capabilities. Small enough for our wristband project and can send data to a phone.
  Battery & Battery Controller: this makes the components
  Phone: Possibly receive data to an app to show user results
  16x2 LCD: Display data to user on wrist

4. Key Features and Functionality

List the main functions/outcomes/goals your project will accomplish.

- Wearable device that is able to calculate the speed at release or at end of arm swing.

- Software to display and log results.

5. Expected Deliverables

What will your team demonstrate at the end of the semester?

- Deliverable 1: A wearable device
- Deliverable 2: A software to display the output
- Deliverable 3: A presentation/demo of device

6. Innovation / Unique Contribution

What makes your project unique? What are your contributions? If you are simulating a work already reported in literature, mention this clearly as well and how you plan to add to the pre-existing work.

This product is unique within the sport of bowling, as most speed calculations to this day are accomplished either through lasers (scoring system), or through cameras (Specto, DIY). Our product will be unique in that it is a wearable (rather than external hardware) that can provide instant feedback and data, at a far less expensive price.

7. Resources Required

Hardware Requirements (if applicable):

Component/Item	Purpose	Estimated Cost
Silcone Band/Strap	Allow for wearability	$20
BNO055	9-Axis Orientation IMU	$30
16x2 LCD Display	Displays Information	$15
3.7V 1000mAh LiPo Bat	Battery	$10
TP4056	Battery Management/Protector	$6
Seed Studio XIAO SAMD21	ARM MCU w Bluetooth	$20
Cables, Breadboard	Misc	$20

Software Requirements (if applicable):

- C/C++ Programming IDEs

-Arduino

-Data Visualization

Other Requirements or Constraints:

_____

8. Project Timeline and Milestones

Provide a realistic timeline with major goals laid out, Week 3 (current) to Week 15 (presentation week)

Week 4 - Begin purchasing equipment

Week 5 - 8 - put equipment together, test that the equipment works properly

Week 9 - 13 - Create code and software to run the equipment

Week 14 - 15 - finalize report and presentation

9. Risks and Challenges

List at least one challenge you may face and how you plan to address them.

Everyone having the time off to work at the same time will be challenging. This can be addressed through proper communication and scheduling to try to maximize time to cooperate.

Incompatible components, maybe we discover that modules aren't compatible even after extensive research. Go back and research for the correct components.
Components arrive faulty. The manufacturer would need to send us new parts to replace faulty parts, and buy more than one component to prevent long wait times.
Sensor in-accuracy/calibration. Create a calibration algorithm or try to create an environment where sensors can be as accurate as possible.

10. References / Related Work (2–4 sources)

The references should be in IEEE referencing format. You can also consider Zotero for bibliography management.

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6642108

https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8700421

Student Confirmation Checklist

☐ Our project scope is realistic for one semester - yes

☐ We identified the required hardware/software resources - yes

☐ We clearly outlined the assigned tasks for each team member - yes

☐ We understand that regular updates will be required by the instructor throughout the semester - yes

11. Regulatory / Approval Considerations

State your use case (general wearable, medical diagnosis/intervention). Then answer the following, assuming your prototype will be undergoing a regulatory process based off on the target use case:

- Does this project involve medical data, diagnosis, or treatment?
- Would this device/software fall under FDA oversight (Class I, II, or III)?
- Are there privacy considerations (HIPAA) or human-subject requirements (IRB)?
- Planned Approval/Compliance Approach:

Our project is a general wearable with no medical diagnosis. It will not involve any medical data, diagnosis, or treatment. It will also not fall under FDA oversight and there are no privacy considerations or human-subject requirements.