Enhancing Sports Fandom Through IoT:
Backend Dashboard, Monitoring, and Embedded Client Development

Project Description

Sports IOT LLC

Sports IOT

Enhancing the fan experience through internet-connected sports memorabilia

By: John Swensen and James Swensen

30-FA25-SP26-SIL-GEN

Gaynay Doo

Modeste Mahouna Houenou

September 10th 2025

I. Introduction

College sports have long been a cornerstone of American culture, drawing passionate fans who follow their teams through every season and every nail-biting finish. While scores and highlights are easy to find online, fans often want a more tangible way to celebrate their favorite team's victories something that lives on their desk and keeps the excitement close at hand.

Our project, **Sports IoT**, delivers exactly that. We are developing a compact, network-connected display featuring a college sports team's logo that sits on a fan's desk and lights up when the team scores or wins. Behind the scenes, the system scrapes real-time data from official sports sites, processes it through a database and API, and pushes updates instantly to the device via WebSockets. This turns live stats into a visible, personal beacon of school pride while also being designed for easy deployment, efficient debugging, and reliable performance across different sports and schools.

II. Background and Related Work

Our project involves the intersection of live sports data and small scale connected devices on your local network. Specifically, we're working with a desk-sized, logo-branded display that lights up when a fan's chosen college team scores or wins. In this sense the project falls into the broader domain of "Internet connected notifications devices for sports entertainment. Combining real-time data scraping, efficient backend design, and embedded hardware, this gives a relatively new domain.

For Background research, we looked at similar existing products and technologies.

Connect Fan Devices:

There are already similar consumer products that bring sports scores into the physicial world. For example, Budweiser "Red Light" hocket siren that was a wifi device that illuminated and sounded a horn when the owner favorite NHL team scored. There are also ESPN desktop widgets and companion apps that show live scores. However, most of these apps are either sports specific, discontinued or locked to a single data source, limiting flexibility for fans who follow multiple college teams.

Real-time sports data feeds:

Large sports organizations like the NFL and NBA maintain their own stats portals. These are often geared towards media outlets or paying partners rather than individual deevelopers. As a result, our client rely on web scraping to pull live scores. This introduces challenges of parser maintenance and error handling when websites change layout.

Back-end and device communication:

In the IoT space, devices typically poll a server or use push-based protocols such as WebSockets. Our client wanted to use WebSocket's because polling every few minutes is simple but can cause a delay and WebSocket's allow for near instant updates but require a more sophisticated server. Our client came up with the solution to use Dockerized for back-end and modularize microcontroller firmware i.e Platform IO, for small scale commercial IoT projects because they simplify deployment and updates.

To succeed we need to continue improving our proficiency in three area:

- Writing robust, adaptable scrapers and parser for varied sports websites.
- Designing a fast, easily maintainable Postgres database with notification signal.
- Developing minimal, reliable firmware for microcontrollers that securely connect over Wi-Fi and respond instantly to updates.

By combining lessons from previous consumer devices with modern web and IoT practices, our project seeks to deliver a flexible, reliable, and engaging way for fans to celebrate their teams in real time.

III. Project Overview

Sports fandom is deeply personal, and fans increasingly seek interactive and immersive ways to celebrate their teams. The aim of this project is to contribute to building and enhancing all the components that are needed for these connected devices to work in an intuitive yet unique manner with the intent of giving fans a more engaging experience. The successful completion of the project would lead to several deliverables, including the backend infrastructure with a system integration, a demo application/admin tools as well some documentation. The proper functioning and connection between all these systems would not only lead to devices that communicate live game outcomes using LED indicators according to preferences set by the users, but also an easier for any user user to know how everything is working, if need be.

Building on this foundation, the backend infrastructure will employ Dockerized services such as a database, scrapers, and an API. The scraper prototypes will pull real-time sports data, the SQL database with defined schema will be used for storing game/team data and the API will help for device communication and admin functions. The system integration will then entail an end-to-end pipeline where we go from data scraped to storing such data and then pushing to device in real time, all of which will be made possible mainly by connecting WebSockets. The device in question is uniquely registered to *a school* and *a sport.*

Complementing the backend, the demo application will be mainly a dashboard or monitoring interface that will be used to add or remove schools, check how many devices are connected sports as well that people are registered for, push updates, but more importantly perform system health checks.

On the hardware side which builds upon the software system described above, the device has a main base which houses the primary hardware, with the specific university logo on top of it (this is what constitutes the lighting housing). It features a microcontroller-driven circuit board with LEDs that reflect game status. The project builds on prior work, extending both hardware and software systems to create a more reliable, scalable, and user-friendly solution.

By combining all these elements (real-time data pipelines, resilient infrastructure, and intuitive behavior), the project aims to provide fans with a personal and celebratory way to stay connected to their teams. In doing so, the project also contributes to the growing landscape of IoT-enabled fan engagement technologies.

IV. Client and Stakeholder Identification and preferences

Our primary project sponsor is Sports IOT LLC, where the CEOs and point-of-contact are the brothers John Swensen and James Swensen. Our initial meeting took place with John Swensen, and he expects a working proof of concept that demonstrates the potential of connected devices in fan engagement. Some foundational work had been done in regard to this project but there's a lot more that still needs to be done. The client's key requirement is a reliable, maintainable system that can be demonstrated live and potentially scaled to multiple schools and sports. A soft requirement is to make a well-rounded webpage where users can set their preferences, but it isn't the principal focus of this project.

Our stakeholders include:

- **Fans (end users)**: Seek devices that are fun, responsive, and simple to set up and use. They prefer seamless Wi-Fi setup, instant updates during games, and clear LED indicators that match team events and their statistics.
- **Schools and sports organizations:** Require devices that can be uniquely identified, registered, and associated with specific teams, while maintaining ease of deployment.
- **System administrators/maintainers:** Need visibility into device health, straightforward update mechanisms, and scalable backend infrastructure as the need arises.
- **Future development teams:** Prefer modular code, clear documentation, and maintainable systems to build upon.

In summary, while the essential requirement is dependable real-time fan engagement, our stakeholders' needs require we emphasize and take into consideration ease of use, maintainability, and scalability as critical preferences throughout the development process and its associated tasks. All these will allow for long-term adoption and success.

V. Glossary

Microcontroller: A microcontroller unit (MCU) is essentially a small computer on a single chip. It is designed to manage specific tasks within an embedded system without requiring a complex operating system.

WebSockets: Also known as the WebSocket API, it is a computer communications protocol that makes it possible to open a two-way (bidirectional) interactive communication between the client (like the user's web browser) and a server over a long-lived connection.

mDNS: This stands for Multicast DNS, which is a protocol that helps devices on the same local network to resolve hostnames (like printer.local) to IP addresses, without needing a central DNS server.

API: An Application Programming Interface is a set of rules, protocols, and tools that allow different software programs or components to communicate and interact with each other. They define the way requests and responses are formatted and exchanged, making it possible for one program to ask another for specific data or actions.

SQL Database: A type of database that stores and organizes data in highly structured tables of rows and columns, similar to a spreadsheet, and lets you manage that data using the SQL (Structured Query Language).

Scraper: A piece of software (sometimes called a "web scraper") that automatically collects data from websites or APIs.

Docker / Dockerized: Docker is an open-source platform that allows developers to package applications and all their dependencies into a standard unit called a "container". These containers can then run on any system that supports Docker, regardless of the underlying hardware or operating system, ensuring consistent behavior across different environments. Dockerized or containerized services refer to software applications that have been bundled into containers using Docker.

Wi-Fi: A wireless networking technology that uses radio waves to provide high-speed internet and network connections to devices like laptops, smartphones, tablets, and smart gadgets, without cables.

IoT: Refers to the network of physical objects that are embedded with sensors, software, and other technologies to connect and exchange information with other devices and systems over the internet

LED: It stands for Light-Emitting Diode and is a semiconductor device that emits light when an electrical current passes through it.

VI. References

[1] J. Schneider and I. Smalley, “What is a microcontroller? | IBM,” *www.ibm.com*, Jun. 04, 2024. https://www.ibm.com/think/topics/microcontroller (accessed Sep. 10, 2025).

[2] Mozilla, “The WebSocket API (WebSockets),” *MDN Web Docs*, Nov. 28, 2019. https://developer.mozilla.org/en-US/docs/Web/API/WebSockets_API (accessed Sep. 10, 2025).

[3] “Multicast DNS,” *Wikipedia*, Nov. 19, 2020. https://en.wikipedia.org/wiki/Multicast_DNS (accessed Sep. 10, 2025).

[4] “Introduction to web APIs - Learn web development | MDN,” *MDN Web Docs*, Dec. 19, 2024. https://developer.mozilla.org/en-US/docs/Learn_web_development/Extensions/Client-side_APIs/Introduction (accessed Sep. 10, 2025).

[5] Microsoft, “What is a SQL Database? | Microsoft Azure,” *azure.microsoft.com*, 2025. https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-sql-database (accessed Sep. 10, 2025).

[6] Tafara Muwandi, “What Are Scrapers and Why Should You Care? | F5 Labs,” *F5 Labs*, Aug. 02, 2024. https://www.f5.com/labs/articles/threat-intelligence/what-are-scrapers-and-why-should-you-care (accessed Sep. 11, 2025).

[7] GeeksforGeeks, “What is Docker?,” *GeeksforGeeks*, Jul. 24, 2020. https://www.geeksforgeeks.org/devops/introduction-to-docker/ (accessed Sep. 12, 2025).

[8] “The future of work is here with Wi-Fi 7.,” *Cisco*, Jul. 2025. https://www.cisco.com/site/us/en/learn/topics/networking/what-is-wi-fi.html (accessed Sep. 12, 2025).

[9] Wikipedia Contributors, “Light-emitting diode,” *Wikipedia*, May 27, 2019. https://en.wikipedia.org/wiki/Light-emitting_diode (accessed Sep. 12, 2025).