Project Road Map for Virginia Tech Recreational Sports with the Intent of Implementing Heat Mapping in Gyms

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Spring 2019

BIT 4484

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Introduction

The team identified four feasible options for monitoring utilization at McComas Gymnasium for Recreational Sports at Virginia Tech. The goal is to one day translate data collection into a real-time heat mapping system on the McComas website. These include: monitoring traffic via wireless internet connections, monitoring traffic via cameras, machine utilization via monitors or updated equipment, and incorporating the step of swiping out of the facility. The team has gathered research anticipating that the project will ensue with another Project Managment team or with Recreational Sports directly. The following roadmap expands on all these options, including potential costs incurred and feasibility taking into account current systems.

Supporting Research

This table breaks down different visualization and data analysis software that would be suitable for creating a dashboard of Rec Sports' survey data. In addition to the survey-analytics dashboard that our team created, these software packages would also be capable of creating a heatmap to visualize gym traffic. Rec Sports has expressed interest in one day having a live heatmap published online and each of these tools would be able to do so, but at varying cost and performance levels. This heat map would show live traffic in McComas, ideally with a view of traffic in different areas of the gym. Alongside possible technology and data-gathering improvements in the gym, a future project team could use one of these tools that they feel most comfortable with to develop this heatmap. All of these software suites are able to publish a live heatmap online.

Software	Pros	Cons
Tableau	· Product recognized as industry standard for data visualization · Free Student license available to learn and create · In-demand software and skillset · More workshops/guides available due to high demand · Very clear/organized/diverse visualization properties · Survey analysis feature	· Very little hands-on experience with the platform on current team · Must manage learning curve · Tableau is slower at processing calculations than QlikView · Very high prices for business use ($70/month)
QlikView	· Free Personal & Business use · Much more affordable alternative (~$15/month) to Tableau's $70/user/month fee · Survey analysis feature	· New platform for entire team · Must manage learning curve · QlikView menus have many unstructured tabs that make navigation difficult · Tableau has a cleaner interface that's more user-friendly
Klipfolio	· Free academic version · Many different plans and features available · Great visualization tools · More Affordable --$29/month, or $49/month for live-feed publishing	· New platform for entire team · Steeper learning curve to manage · Less powerful BI features than other options · No forecasting tools · Extra cost for
Power BI	· Free for students at VT · Free for faculty at VT · Robust analysis/visualization tools	· New platform for entire team · Must manage learning curve · Less flexible in deployment than other tools

		· Less support available online than other tools
Excel	· Free for students at VT · Fairly extensive experience on current team · Free for faculty at VT · Popular software; most have some level of experience, basic skills · Easiest to maintain/alter going forward · Lots of online resources/support	· Not as flashy as other tools · Not quite as visual-oriented as other software (though still highly capable)

Wireless Access

Heat mapping real time data is one of Sports Rec's long-term goals. Heat maps can be generated through proximity beacons that include radio frequencies, wi-fi, NFC, or Bluetooth-based technologies embedded in ID badges or other wearables. These beacons connect to receivers that map devices to locations which can be used to generate traffic patterns.[4] If it is determined that Rec Sports will invest in one of these technologies, Rec Sports has to consider privacy, cost, and other factors.

The issue of privacy arises with this technology, but what students do not know is that they have been tracked for years now without even knowing it. Some students are unaware that they have been using heat maps regularly by tracking their runs through fitness applications, finding people's location through iPhone's Find My Friends, and even following their route home while riding in Ubers. The introduction and rise of beacons and other sensing technologies have just allowed marketers to track traffic.[4] Most shopping malls and airports are investing in this technology, without having to tell their customers. Most companies work with the existing Wifi infrastructure, and by using the signals, one can triangulate the location of each mobile device automatically obtaining location data without customers having to download an app or connecting to the Wifi – making the data is anonymous.

Many companies that offer these services and software's tend to only work with larger scaled buildings such as airports, shopping malls, and large retail chains. There are other companies that could offer their services to smaller facilities. For example, Aislelabs is a company that provides a product called AislelabsFlow that uses cloud-based location analytics to track real-time customer behavior. One of the features they include in their software packing is a live dashboard that allows users to track customer dwell times, visiting patterns, and more. Along with their many other features, they do include a heatmap that traffic and top walking paths.[5] The team reached out to Aislelabs to get a quote on how much it would cost Recreational Sports to establish this technology. With McComas being 118,225 sq ft with 30 Aruba network access points, the monthly price would be $1,425. This package includes all set up and on-boarding fees, as well as all features included on the site. It would be a standard 1-year agreement with all data collected being 100% owned by Virginia Tech. For more specific information on this, the quote can be found down below.

Seeing as Mccomas is prone to having high traffic during certain times of the day, having heat mapping would be very beneficial to VT Recreational Sports. Having this real-time data would increase customer experience and satisfaction as well as increasing data accuracy. The cost of implementing this technology will vary from size of facility (Mccomas and War) which will require quotes from different companies. Using this technology would allow Recreational Sports to reach their long-term goal.

Please find detailed pricing for the 30 Aruba access points and Flow below.

Keep in mind that as part of our on-boarding your account manager will look at your floor plans and tell you how many zones we can create without changing anything at all. More access points, more granular you can get. Rough rule of thumb is around 1 zone/space for every 4 access points but it all depends on how and where they are currently placed. If you'd like you can share the floor plan and the AP placements with me and I will provide mock ups of how many zones you should expect with your existing set up.

Below is a summary feature list for each product. Flow is the last one.

Flow (Anonymous Traffic Analytics):
- Full on-boarding and training
- Zones based on floor plans desired (if applicable)
- Heatmaps (dependent on density of APs)
- Unlimited data storage and export
- Zone specific analytics
- Top Paths
- Space Rankings Reports
- Floor Ranking Reports
- Footfall & Dwell-time by spaces
- Calendar View Including Weather reports

Aislelabs Flow Pricing Information for 30 Aruba access points: $1425 per month (includes all set up and on-boarding fees)

- *Standard 1-year (12-months) agreement*
- *Access to an account manager for on-going support*
- *All the data collected is 100% owned by Virginia Tech University*
- *Licensing includes 24/7 technical support*
- *Payment Method: Cheque, Wire Transfer or Credit Card*
- *Currency: USD*

Swiping Out

A potential system that we research is a swiping-out method for users of McComas Gymnasium. For years, McComas has solely enforced a swiping-in system to check for active accounts, track the amount of users, as well as to collect data about usage times. However, a swiping-out method has never been deployed.

The greatest benefit of swiping out would be that McComas staff will be able to collect real-time and accurate data about patrons. The staff currently walks around the gymnasium every hour to inspect each room to determine how many users are present. Then, they manually calculate the amount of people at the gym. This method is not only timely and costly, but it is also not accurate. Users leave the gym frequently, so it is difficult to determine exactly how many people are at McComas at all times. Our research determines that swiping-out may be a better tracking method.

Potential disadvantages to swiping-out are minimal but do include additional congestion at the front desk. While there is low traffic and waiting time for incoming users now, we anticipate that the creation of outbound monitoring will create traffic at the desk. The act of swiping patrons in-and-out is time-consuming. The McComas front desk is currently equipped with two card swiping scanners and two computers. If swiping out were to be incorporated, a solution could be the installation of more card scanners. Upon research, we determined that the investment of additional magnetic stripe swipe card scanners will cost as low as $17 per reader[5]. If McComas were to decide to pursue this route, more computers at the desk would not be necessary, as more than one scanner may be connected to existing computers via USB.

Another solution could be to hire additional staff to monitor the front desk. However, we do not determine this to be a high priority. As regular users of McComas Gymnasium, the team has observed that, on average, two to four staff members are present at the desk. Therefore, it would be unlikely that hiring more staff would be beneficial or necessary to reduce congestion at the desk.

In order to collect the most accurate data to eventually develop a real-time heat mapping system, we recommend for McComas Gymnasium to adopt a swiping-out method. Since the front desk is typically well-staffed, we anticipate a lack of enough scanners as the greatest threat

to traffic. Therefore, we highly recommend purchasing more card scanners to quickly and accurately determine how many users are at McComas Gymnasium at all times.

Adapting/Improving Equipment

There are cloud connected sensors that can be added to equipment to show machine utilization. ECOFIT Networks, a company out of canada states, "As a 'brand-agnostic' solution, our sensor is compatible with nearly all of the equipment on the market," says Dave Johnson, the firm's vice president of business development. "It communicates wirelessly to a gateway—one the size of a smartphone—that we provide." [3] Their brochure can be located here. 24 Hour fitness, Gold's Gym, and Planet Fitness are a few of the gyms that utilize ECOFIT Networks's technology according to their website.

Life Fitness is a company that manufactures high tech workout equipment. When using this equipment people can link an LF account which records their workouts and monitors progress via a bluetooth connection. In a quote taken from the Life Fitness website they state that, "managers can set up, name and place their Life Fitness connected equipment on a grid that resembles their specific gym layout. The grid can accurately mirror any fitness room, with the ability to represent elements such as a front desk or aisles." [1] This allows a facility to see gym utilization in real time and allows gym-goers to more easily track progress and workouts.

A fully equipped commercial gym typically spends around $50,000 on equipment alone. That number could be exponentially higher with a gym the size of McComas and with technologically that is more advanced. Unfortunately it is hard to obtain a quote for the facility. In a quote from their VP of Development, the quoted price is $60 per sensor that goes on all equipment and $1,495 for a gateway which is the central receiving unit with no additional fees. There is also a monthly service option in which you pay a "small monthly fee" and the sensors are discounted to $36.

Many facilities are gathering more data than Rec Sports may be allowed to since many of the machines available that will require a login and store information. This may be beneficial to increasing overall utilization of the gym as shown in Athletic Business.com, "76 percent of

respondents under 30 said that better access to tech could get them in the gym more frequently. Perhaps most importantly, 33 percent of gym members would be willing to switch gyms for better technology, if the price and location were similar." [2] It would however be expensive and might be easier to implement in War Memorial Gym if the restoration project includes buying newer equipment for the facility.

Cameras

The installation of cameras in every room of the gym complex is definitely a goal that should be worked towards, as it could be a key tool to an efficient, accurate heatmap of the rooms' occupancy. If cameras are installed and the feeds able to be viewed through a monitor, it would be easy to perform a headcount of the capacity of each room in the gym. An employee can just count the number of people, and they can record the information in the same way it is done currently. This would be a more efficient solution to designating a worker to walk to every room and tally. Since this can all be done while staying in the same place viewing the live feeds, it is less likely that a gym-goer will move to a different room in the shorter amount of time. This can potentially lead to a more accurate headcount of each room.

Another potential pathway that can count the occupancy of a room in McComas would be using facial recognition software. Facial recognition software, while hard to implement by yourself, has many open source versions already made. Depending on the cameras used, and the frame rate of the camera, or rate per second that the camera takes still frame pictures, some software may be better suited for this.[8] OpenCV is a great tool for facial recognition that is free to use.[9] The development of this solution could still prove difficult, and there are some definite challenges that would have to be addressed and solved. The system would need to count a person even if their back is to a camera. If this system is completely counting the people in the gym, it would need to know how to delete a person when it leaves the room and add it back when they go into another room.

With these solutions in mind, there are some definite general benefits to installing cameras. Having these installed with a live feed could serve a dual purpose: you can use them to

count the capacity of the gym, as well as add a measure of security to the facility. One of the trademarks of this campus has been the assurance of safety, especially when on campus grounds. This could be a great marketing point for the most up to date workout facility available for student use on campus. However, the use of cameras is a definite expense, so the funds must be provided in order to go through with the purchase, setup, and maintenance of the system. Obtaining this quote is difficult, since there is a great deal of variability depending on factors such as the type of camera and the range of vision in certain rooms. These factors ultimately contribute to a different estimate of how many cameras would be needed to obtain a complete live feed of McComas.

Conclusion

The team acknowledges that various infrastructures for the stated recommendations are not currently utilized by McComas Gymnasium. However, the research above details how these options are feasible to adopt. That being said, some may be more easy to implement immediately. If Recreational Sports chooses to implement these options incrementally, the team recommends to begin with a swiping-out method. This system is by far the most optimal solution, due to its low initial cost and easy implementation. The most feasible option the team would recommend is Wifi implementation because of its ability to be anonymous while still collecting valuable usage data and because the gym is already wifi equipped. The last option the team would recommend which would be a long-term solution is cameras which has the added benefit of security for the gym. However, if privacy concerns are too great, utilizing machine monitors would be an efficient way to get a live stream of machines and gym equipment being used and, if used in conjunction with swiping out, provide an accurate depiction of gym utilization.

Works Cited

1. Life Fitness Adds Heat Map Technology to LFconnect Platform. (n.d.). Retrieved from
      https://lifefitness.com/pressreleases/life-fitness-adds-heat-map-technology-lfconnect-platf
      orm

2. Scott, J. (2017, October). How Tech Is Creating 'Smart' Fitness Facilities. Retrieved from
      https://www.athleticbusiness.com/fitness-training/how-tech-is-creating-smart-fitness-facil
      ities.html

3. Feld, J. (2018, December 11). Cloud-connected Sensors Are Helping Gyms Track Equipment
      Use. Retrieved from https://www.ihrsa.org/improve-your-club
      /cloud-connected-sensors-are-helping-gyms-track-weight-and-cardio-equipment-use

4. What's a Heat Map? (2017, November 14). Retrieved from
      http://contemporaryproductions.com/heat-map-whats-heat-map/

5. Guest WiFi, WiFi Marketing, and WiFi Marketing Analytics. (n.d.). Retrieved from
      https://www.aislelabs.com/

6. Magnetic Reader Swiper. (n.d.). Retrieved from
      https://www.amazon.com/2xhome-Magnetic-Registry-Register-Quickbook/dp/B00E85T
      H9I/ref=asc_df_B00E85TH9I/?tag=hyprod-20&linkCode=df0&hvadid=167140485757&
      hvpos=1o7&hvnetw=g&hvrand=3286349159030071027&hvpone=&hvptwo=&hvqmt=
      &hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9060046&hvtargid=pla-306946219383&
      psc=1

7. Atherton, N. (2014, September 29). Face detection / face recognition explained. Retrieved
      from https://www.whatdigitalcamera.com/technical-guides/technology-guides/face
      -detection-face-recognition-explained-15298

8. Biometrics. (2017, February 06). Retrieved from https://www.dhs.gov/biometrics

9. OpenCV. (2019, April 17). Retrieved from https://opencv.org/

10. Products. (n.d.). Retrieved from https://www.tableau.com/products

11. A Complete Business Intelligence (BI) Platform. (n.d.). Retrieved from

  https://www.qlik.com/us/products

12. Dashboard Solutions from Klipfolio. (n.d.). Retrieved from

  https://www.klipfolio.com/solutions

13. Power BI | Interactive Data Visualization BI Tools. (n.d.). Retrieved from

  https://powerbi.microsoft.com/en-us/

14. Microsoft Excel. (n.d.). Retrieved from https://products.office.com/en-us/excel