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Unleashing Potentials
Shaping the Future

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"Micro-Motions Magnified: Quantifying Diminutive Human Movement"

MUHAMAD NOOR MOHAMED
UiTM KAMPUS SEREMBAN

Human movement is all about how our bodies go from one place to another and how we carry out different actions. It's not just as simple as moving from point A to point B; it involves a whole dance of different body parts working together. Think about your muscles, bones, nerves, and even your heart all teaming up to make you walk, run, jump, or do anything else. It is pretty intricate, involving a mix of body systems like bones, muscles, nerves, and the heart. Different moves have their own style of coordination, control, and adaptation, depending on what you're up to. Researchers have cooked up various models and methods to break down and study human movement, ranging from the theory-heavy to the data-focused. Some models dig into how our bodies are built and work, while others zoom in on specific moves and how we do them. Each type has its ups and downs based on what we are trying to find out and the info we've got (Vieten et al., 2020).

From flexing and extending to twisting and turning, our bodies have a whole repertoire of moves. Picture this: flexion, extension, abduction, adduction – these words describe how body parts do their thing. And don't forget about rotation, pronation, and supination – they're like the twists and turns in our body choreography. With circumduction, deviation, opposition, repositioning, inversion, and eversion in the mix, our body parts are dancing to their own beat. Each term tells us which way a body part is heading or how it is positioned compared to a reference point. Let's get moving and explore the vibrant language of human motion! (Rad, 2023). Human movement is the amazing and complex way our bodies get around and do stuff!

Measuring human movement is a diverse game, with researchers using different tools and techniques based on what they are looking into,

how accurate they want to be, and what they are trying to find out. Some popular methods include electrical linkage, stereometric, biplanar roentgenographic, and accelerometric approaches (Zatsiorsky, 1976). Electrical linkage works by using gadgets like potentiometers or encoders on joints or body parts to track how they move.

Diagram 1: Motor Control and Learning Laboratory

Stereometric methods rely on cameras or optical devices to follow markers on the body, figuring out how things move in three dimensions. Biplanar roentgenographic methods snap X-rays from different angles to peek into skeletal and joint motion. Accelerometric methods, on the other hand, stick accelerometers or gyroscopes to body parts to measure how they speed up or spin (Zatsiorsky, 1976). Every method has its own perks and downsides, like how precise or invasive they are, and researchers have to weigh these factors when choosing the best way to measure human movement.

Unleashing Precision: Our Toolbox at FSR Seremban

At FSR Seremban, we are all about capturing motion with flair. Our secret weapon? The OptiTrack Prime x13 is a motion capture marvel equipped with eight high-tech optical cameras.

Think of it as a master of precision, ready to track the tiniest twirls in medium-sized spaces.

With a whopping 1.3-megapixel resolution and a blitzing 240 frames per second, it's not shy about keeping up with speedy moves that zip past 125 mph. We are talking pinpoint accuracy at +/- 0.20 mm and rotational error of less than 0.5 degrees.

Diagram 2: OptiTrack Prime X13 MOCAP Camera

But wait, there is more! This camera flaunts a custom-made, distortion-busting lens decked with a super-charged anti-reflective coating. More light means better 3D data quality. Plus, its tricked-out filter switcher toggles between infrared and visible imaging while built-in wizardry spots markers and their centres.

Mix and match? You bet. Pair this camera with passive or active markers, and team it up with its camera pals in the Prime and Prime X crew. It's all about crafting the perfect setup for any gig. Compact, light, and stealthy with its 850nm IR magic, this camera is perfect when you need slick tracking without the fuss. At FSR Seremban, we capture motion one frame at a time (Optitrack-In Depth; Optitrack-Slimx 13; Optitrack-Support, 2023).

In a recent graduate endeavour, we unleashed the power of this cutting-edge system, putting Malaysian Varsity Pro-golfers under the spotlight. Our quest? To delve deep into the golfer's realm, uncovering the tiniest nuances in swings and ball contacts as speeds soared from 100 to 200 miles per hour. Here is the twist: We pitted the standard-length club against the one-length club. We even tinkered with the length and head weight of the most iconic duet, the five and the six, to unravel the performance secrets. Brace yourself for the grand reveal of pros, cons, and golf!

Mastering the golf swing is a complex art that demands a blend of coordination, strength, speed, and precision. The performance of your swing is like a symphony, conducted by factors like biomechanics, fatigue, psychology, injuries, and even the surroundings. Central to the swing's magic is the arm's speed and the club's contact point with the ball – these two factors hold the key to victory. Now, throw in a twist: different club lengths mean adjusting the angle of attack for that perfect connection. According to a study, the average speed of the swing is – the club head and ball – clock an average of 50.1 to 70.6 m/s (Horan & Kavanagh, 2012). Plus, the study highlighted that the thorax segment is the speed champ of the upper body during the swing dance.
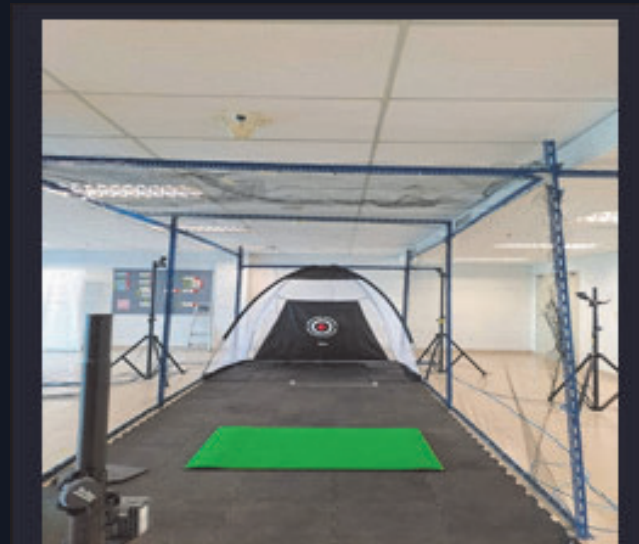

Diagram 3: Setup for Golf Swing Analysis

For golfers seeking greatness, it is time to fine-tune those segment controls. Our findings reveal that mastering these movements can be the key to unlocking your golfing prowess. Think of it as sculpting your swing symphony to perfection.
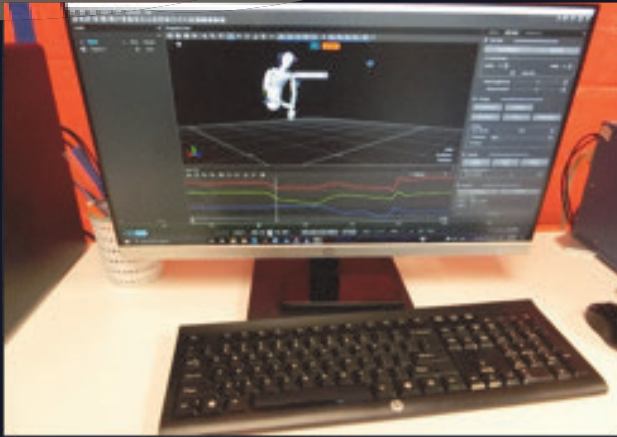
Diagram 4: Data Quantification and Advance Analysis

Diagram 6: Modelling of Softball Batting

Switching lanes to another arena – the softball world – the story continues. Just as we dissected golf swings, we peered into softball batting's intricate dance. It is an upper-body performance driven by pitch type, ball speed, stance, and swing mechanics. Curious minds want numbers, and here they are a study by Syzmanski and Spaniol (2011) unravelled that the ultimate bat weight for the best bat speed and ball velocity is around 12% of your body weight.

Diagram 5: Lab Configuration for Softball Batting Kinematics

However, there is more! This study added another twist: hefting the bat's barrel can hamper your speed and power. The lesson? Softball players take note – pick a bat that syncs with your style, letting you unleash your magic with blazing speed and power.

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