Parts of Speech:

* Nano Technology and Core Concept – Senthil
* Application - Fayaaz
* Hardware - Sahithian
* Software and Prototyping – Senthil

Nano Technology and Core Concept - Senthil:

* Hello everyone, I am Senthil Arasu today we present you UniBot blah blah…
* No this is not a science exhibition project, but this is a Revolution.
* UniBot possess the ability for Humankind to create our own reality.
* Starting from the fundamental idea of the project, that is Nano Technology.
* In simple terms, Nano Technology is when multiple tiny robots work together to accomplish huge tasks quickly and efficiently.
* UniBot is created on the basis of this technology but with Innovation and Real time optimization.
* If we a take a close look at the bot, each bot has very less movement. But when it joins with its team, it becomes an indestructible power. Each bot is controlled and coordinated by a master controller unit which is my laptop.
* UniBots form various objects through arranging themselves in complex structures, navigating between themselves all without human intervention, completely autonomous.
* We will see about the Applications and Hardware, Software and Prototyping sections of UniBot

Hardware – Sahithian:

* The hardware at the heart of this system is the ESP8266 12E Microcontroller, mounted on a custom PCB. It features a 32-bit RISC processor with a clock speed of 80 MHz, along with 4 MB of flash memory, 64 KB of RAM. Integrated Wi-Fi chipset allows real-time control and programming, operating at 3.3v. We have chosen ESP8266 mainly due to its high energy efficiency as it draws only about 20 micro amps at deep sleep and its compactness and cost effectiveness. It allows us to even load our own firmware in it, thus supporting multiple coding languages.
* The main mechanical systems are AD002 servos, offering 2.5 kg/cm of torque at 5V, 180 degrees of rotation for smooth, fast, and accurate movements. Propulsion comes from two N20 geared motors, which operate at 5V DC with a speed of 30 to 100 RPM, delivering 6 to 10 kg/cm of torque for precision and power in a compact and lightweight form. The motors are driven through L293D Motor driver IC.
* Our motherboard is a custom made PCB that is handmade to ensure efficient signal routing, optimal space usage, and power management for all components. In conclusion, this prototype offers a powerful combination of hardware and flexible, real-time software through MicroPython, creating a versatile platform for self-assembling robotics.
* For all these, the main power source is an 18500 lithium ion battery recycled from a power bank.
* On the software side of the chip, we’ve have used MicroPython firmware platform that enabled us to program the Esp8266 chip in Python, using the Thonny IDE, UniBot is compatible with IoT platforms, allowing cloud integration for remote diagnostics and data gathering. ESP8266 wireless capabilities enables real-time Over-the-Air code updates via Wi-Fi, It’s wireless capabilities make it adaptable for applications ranging from real-time control to IoT integration

Software and Prototyping – Senthil:

* Let us take a dive into the remote backend of UniBot:
* The master controller is also programmed with Python allowing effortless coding and easy data manipulation for the robots.
* We have used Transmission Control Protocol or TCP sockets library to communicate through our robots’ Wi-Fi networking system in a master-slave data transmission model for that allows very less latency time as low as 5-8 millisecond latency, enabling immediate response for critical situations. Also this transmission setup promotes hassle-free data exchange between the bots and the master controller
* The input commands for the master controller are given through simple keyboard key mappings, allowing user friendly interaction interface and promoting ease of control. This is done through the Python PyNput library that helps us to read all keystrokes from all kinds of operating systems in one place.
* Now let’s see about “behind the scenes” UniBot, that is the prototyping of UniBot
* Our initial prototyping of physical movements of UniBot arose from the simplest concept of electrical motors that is, how does a motor generate physical movement just by moving electrons? We thank Michael Faraday for his work of electromagnetism that helps us convert electrical energy into physical movement.
* [Image/Animation] So this was the initial articulation of UniBot that allows Extension, flexion, abduction, adduction, rotation, circumduction
* These were controlled by electro magnets that ensures precise movement and rotation.
* And the dummies are used to contain the batteries for the bot.
* Initially when we were designing the physical structure of the robots, we were inspired by MIT’s M-Blocks 2.0 self-assembling robots that generates momentum using its internal flywheel breaking concept that helped them to move on a linear axis. But it contained so much complexity that limited us from forming small structures from it.
* The main control and coordination ideology is based on a feedback system that consists of 3D positioning system. We researched and experimented with such three technologies,
* First of them, is Ultra-Wide-Band indoor localization technology that gave us the accuracy level of 1 millimeter, which is exactly what we wanted, but the commercial Ultra-Wide-Band boards are not available in the market for development as well they were much expensive. They use precise time measurement techniques through which they calculate the distance by measuring the time taken by the signals to reach other anchors through Triangulation. We needed atleast 4 boards, 3 for anchoring and one is the bot, through which we can get only the 2D position of the bot. But they alone cost about 17000inr to imported.
* Then the next technology we implemented is Received Signal Strength Indicator that is RSSI. We experimented with the same Esp8266 chip’s Wi-Fi capabilities and checked the RSSI but they were inaccurate and kept varying even in stationary conditions,
* All together these limitations clamped us down from using 3D positioning system
* In Conclusion, UniBot is an all-in-one solution that empowers man-kind to create a sustainable and technologically evolved future that lets us create our own reality

APPLICATION OF UNIBOT