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, we are Nano Knights 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 connection to a master controller unit which is my laptop.
- UniBots form various objects through changing their shape along with 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.

Applications – Fayaaz:

- The applications of UniBot are endless, our imagination is the only limit for UniBots' ability.
- Most commonly, UniBot creates a major turn over in the field of transportation, as they can move any kind of object to any kind of landscape without losing stability.
- They can be used in Defense sector to secure our territory and defend enemy attacks.
- UniBot can be used in the field of construction as drastically they reduce the time and required man power.
- Let's observe your daily life. We go to a place and if we need a chair, UniBots transform into a chair and offers a seat. Then if we need an assistant to hold something in place, well, UniBots can perform that too.
- UniBots also serve a big hand in the manufacturing industry as assembly robots, cycling from welding to painting industries

Hardware – Sahithian:

- The hardware at the heart of this system is the ESP8266 12E Microcontroller, soldered on a custom PCB. It features a 32-bit RISC processor, 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.

- The main mechanical systems are AD002 servos, offering high torque at a small volume, providing smooth, fast, and accurate movements. Propulsion comes from two N20 geared motors, precision and power in a compact and lightweight form. The motors are driven through L293D Motor driver IC.
- For all these, the main power source is an 18500 lithium ion battery recycled from a power bank.
- 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 creating a versatile platform for self-assembling robots.

Robot Software – Fayaaz:

- On the software side of the robot, 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.
- The main control and coordination ideology is based on a feedback system that consists of 3D positioning system. We researched and experimented with two such 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
- The next segment is the incorporation of AI aided algorithm in the field of structure formation for the robot, using deep learning neural networks.
- We were not able to accomplish these feature due to fund, time and technical insufficiency.
- 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