FIRST REVIEW

RUBBLE RESCUE USING SNAKE ROBOT WITH WI-PEEK

GUIDE: MR. ANNSHAD ASSISTANT PROFESSOR DEPARTMENT OF MECHATRONICS ENGINEERING NEHRU COLLEGE OF ENGINEEEING AND RESEARCH CENTRE

TEAM:
MOHAMED YASIN(NCE20MC013)

CONTENT

ABSTRACT

- Innovative approach to expediting and enhancing the efficiency of urban search and rescue operations
- Utilizes advanced snake-like robotics, wireless communication, and sophisticated sensors to navigate through confined spaces Flexible and modular design allows maneuvering through tight spaces and adapting to unpredictable terrain Equipped with sensors such as cameras, accelerometers, and wifi imaging for identifying and locating survivors.

MOTIVATION

Saving Lives: The primary motivation is to expedite search and rescue operations, especially in the critical hours post-disaster, with the overarching goal of saving lives trapped under rubble.

Risk Mitigation: The snake robot’s deployment minimizes risks to human rescuers, especially in situations where structural integrity is compromised, and traditional methods may pose dangers

Resource Optimization: Working in tandem with human rescue teams, the snake robot optimizes resource utilization, providing a comprehensive and effective approach to search and rescue efforts.

LITERATURE REVIEW

- **See Through Walls with Wi-Fi byFadel Adib**
- Introducing the state-of-the-art "Rescue people under rubble using snake robot with WiFi" designed with robophysics principles to address humanitarian crises. - Incorporates a 12-segment snake robot with advanced 3-D body bending capabilities for efficient traversal through rubble and obstacles.
- **WiFi-based Real-time Breathing and Heart Rate Monitoring during Sleep Yu Gu∗, Xiang Zhang∗, Zhi Liu and Fuji Ren†**
- This paper provides a low cost, continuous and contactless WiFi-based vitalsigns (breathing and heart rate) monitoring method.
- In particular, we set up the antennas based on Fresnel diffraction model and signal propagation theory, which enhances the detection ofweak breathing/heartbeat motion.
- **A Survey on Snake Robot Locomotion G. SEEJA1, AROCKIA SELVAKUMAR AROCKIA DOSS 2, (Senior Member, IEEE), AND V. BERLIN HENCY**

- **Two new design concepts for snake robot locomotion in unstructured environments Pal Liljeb ˚ ack, Kristin Y. Pettersen, ØyvindStavdahl, and Jan Tommy Gravdahl**
- The first design concept is an approach for sensing environment contact forces, which is based onmeasuring the joint constraint forces at the connection between the links of the snake robot. The second design concept involves allowing the cylindrical surface of each link of a snake robot to rotate by a motor inside the link in order to induce propulsive forces on the robot from its environment **SenSnake: A snake robot with contact force sensing for studying locomotion in complex 3-D terrainDivya Ramesh, Qiyuan Fu, Chen Li1**
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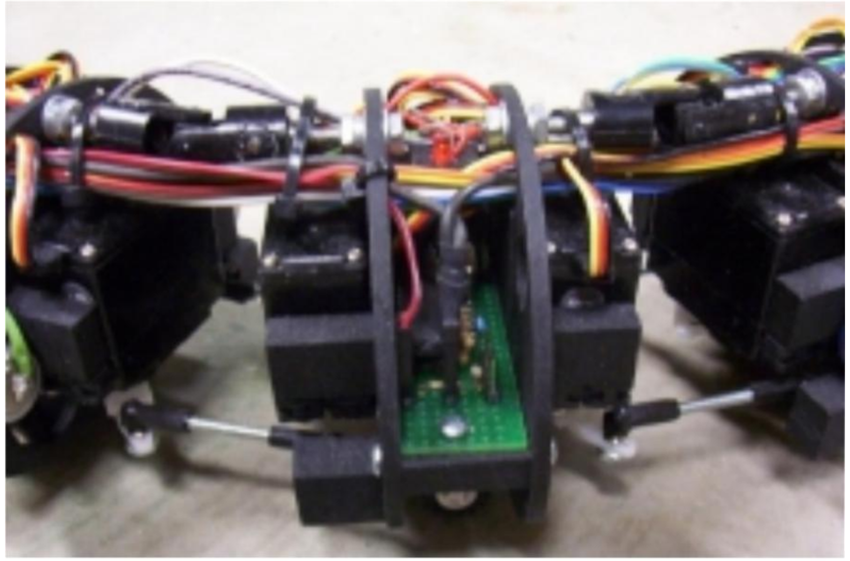
OBJECTIVE

- **Remote Exploration** Deploy the snake robot to navigate through the rubble remotely using its Wi-Fi connectivity to transmit live video and sensor data.
- **Victim Identification** Equip the robot with sensors, such as cameras and thermal imaging, to identify and locate trapped individuals within the debris.
- **Obstacle Negotiation** Enhance the robot's capabilities to navigate through complex rubble by improving its agility and ability to negotiate obstacles.
- **Situational Awareness** Integrate advanced sensors to provide the rescue team with a comprehensive understanding of the disaster site, aiding in decision-making.

LAST PROGRESS

- As of my last update in January 2024, snake robots were being developed for various applications including search and rescue, inspection of confined spaces, and medical procedures. Progress in their development often focuses on improving locomotion, control, and adaptability to different environments. For the latest advancements, I recommend checking recent academic publications or news articles in robotics journals or websites.



CURRENT PROGRESS

- As of my last update in February 2024, snake robots continue to see advancements in various areas such as locomotion, control, and application development. Researchers are exploring new methods to enhance their maneuverability, flexibility, and efficiency in navigating complex environments. Additionally, there's ongoing work to improve their sensory capabilities and autonomy for tasks such as exploration, inspection, and disaster response. For the latest progress, I recommend checking recent publications in robotics journals and conferences, as well as updates from research institutions and robotics companies.

DESIGN METHODOLOGY

- **Hardware Setup:**
  - Choose a good biobiblical snake robot design
  - Choose good servo motor
  - Using wi-peek technology
  - Using sensor ,camera ,hand
- **Interactive Visual Stimulus Design:**
  - Select and implement robust Wi-Fi communication protocols for real-time data transmission. Ensure secure and reliable communication between the snake robot and the control station.
  - Design an intuitive and user-friendly interface for the rescue team to control the snake robot.

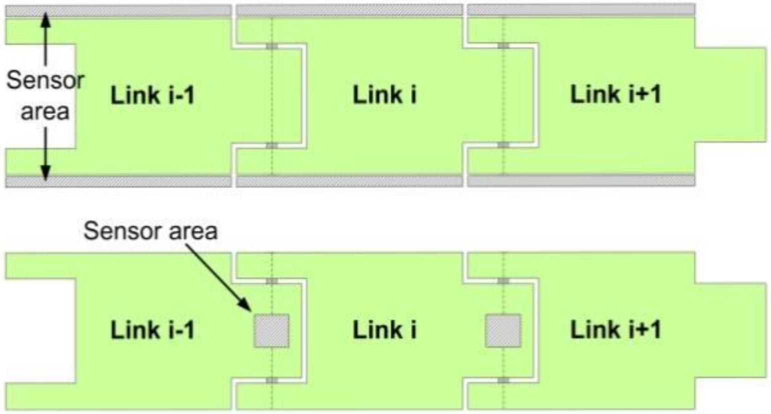
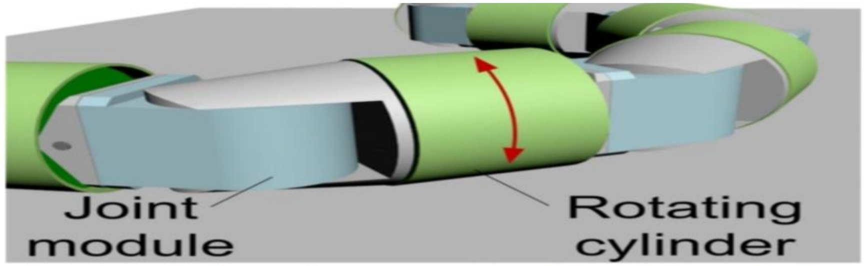
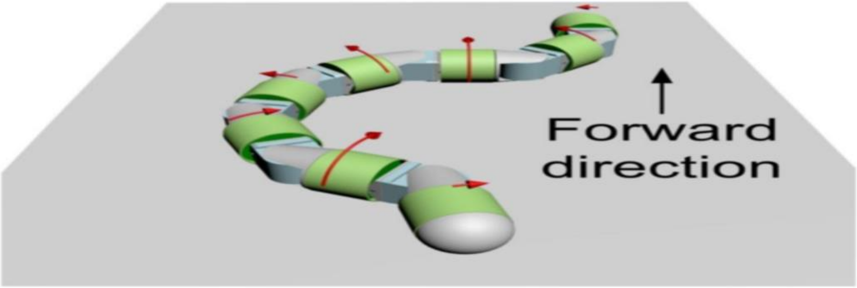


Fig. 3. Top: Sensor area required for direct measurement of external forces. Bottom: Sensor area required for calculating external forces based on internally measured joint constraint forces.



(a) The rotating cylinder generates external forces in the normal direction of the link.



(b) Each cylinder is rotated according to its orientation with respect to the forward direction.

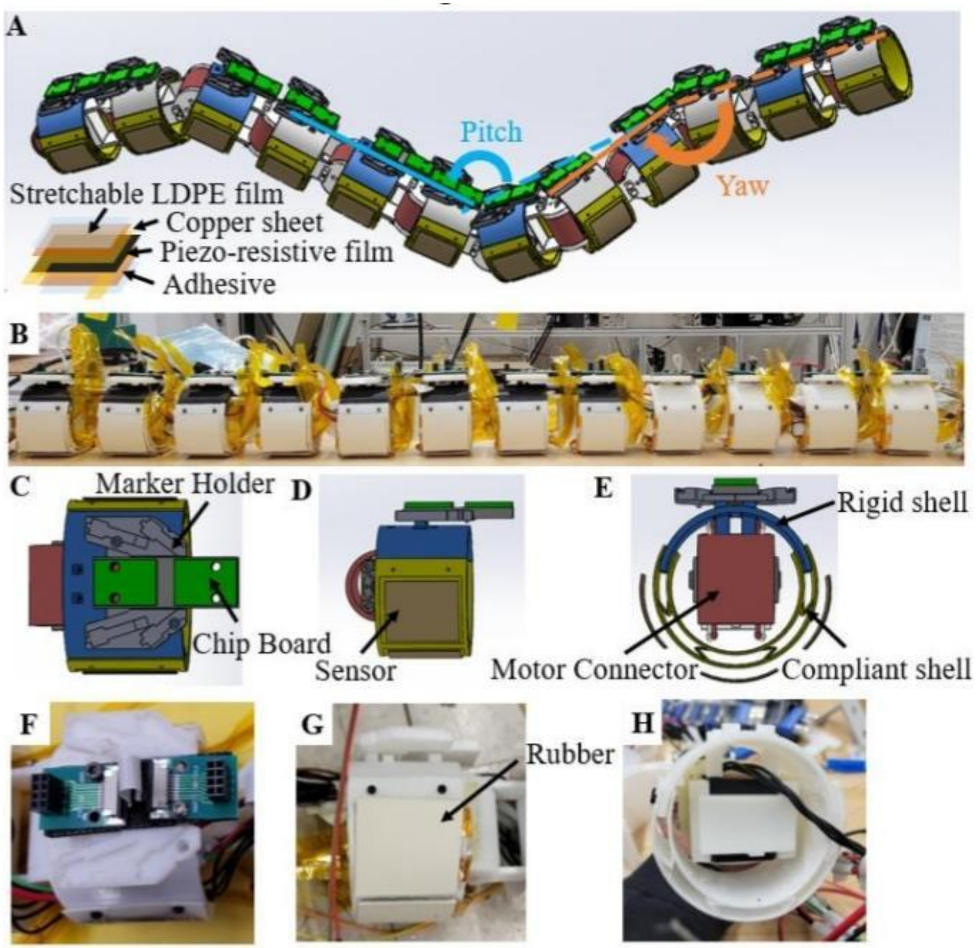
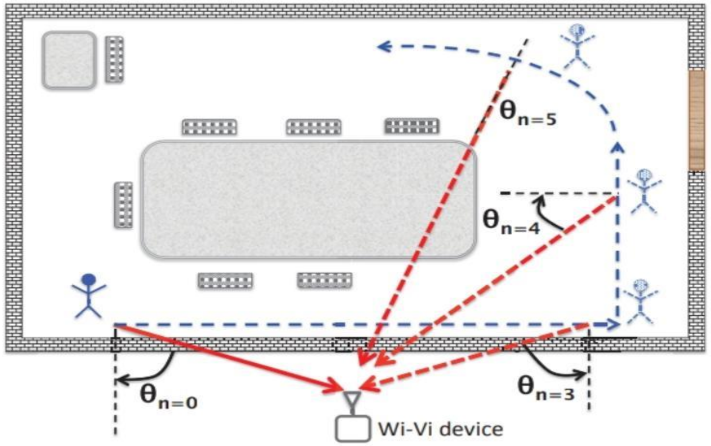
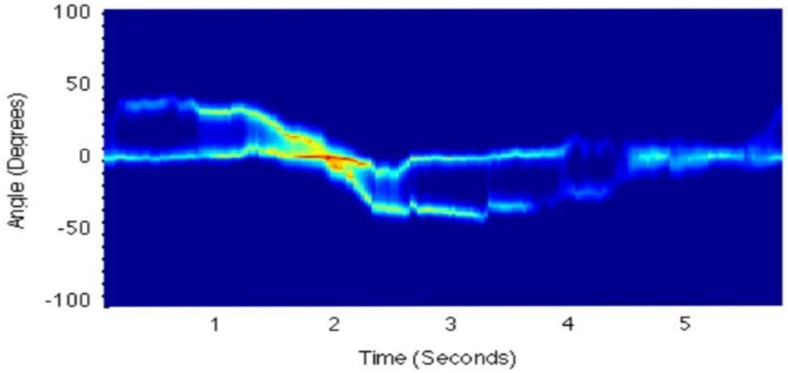


Fig. 5. SenSnake v2 design. (A) CAD showing 3-D bending of robot. (B) Robot photo. Top, side, and front view CAD (C-E) and photos (F-H) of a segment.

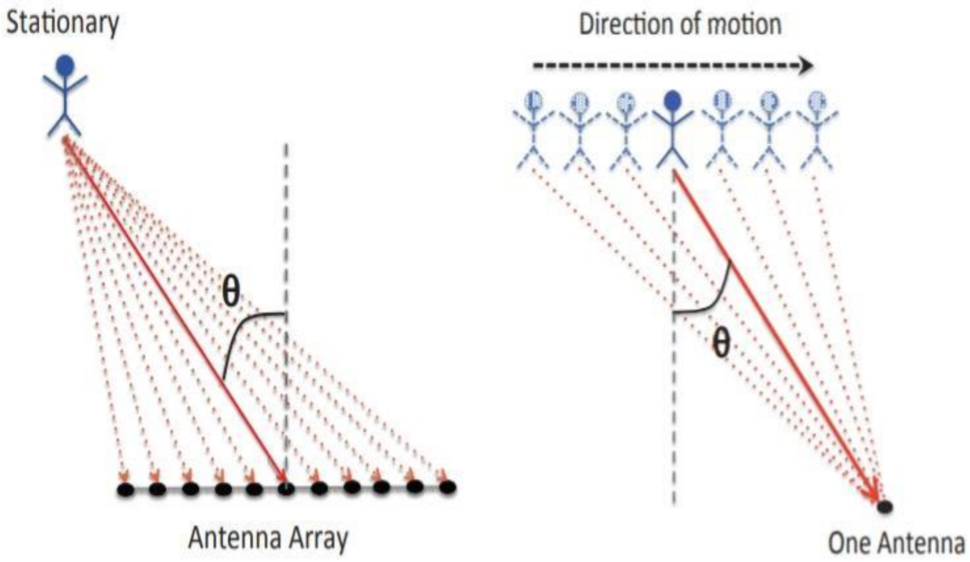


(a) **Experimental Setup**



(b) **Wi-Vi's output**

Figure 3—Wi-Vi tracks a single person's motion. (a) shows the experimental setup of a trial which consisted of a single person moving around in a conference room. (b) shows how Wi-Vi is able to track the motion of the person by computing the variation of the inverse angle of arrival with time, i.e. $A'[\theta, n]$ for θ in $[-90°, 90°]$.



(a) Antenna Array **(b) ISAR**

Figure 1—A Moving Object as an Antenna Array. In (a), an antenna array is able to locate an object by steering its beam spatially. In (b), the moving object itself emulates an antenna array; hence, it acts as an inverse synthetic aperture. Wi-Vi leverages this principle in order to beamform the received signal in time (rather than in space) and locate the moving object.

EXPECTED OUTCOME

- The expected outcome of a rubble rescue snake robot is to navigate through confined spaces in disaster-stricken areas, such as collapsed buildings, and locate and rescue survivors. These robots are designed to be flexible and agile, capable of accessing areas that may be challenging for traditional rescue methods. The goal is to enhance the efficiency and effectiveness of search and rescue operations in complex and hazardous environments.

CONCLUSION

In conclusion, the rubble rescue snake robot proves to be a valuable asset in disaster response scenarios. Its ability to maneuver through rubble and debris, coupled with its capacity to perform search and rescue operations, makes it a promising tool for enhancing the efficiency and safety of emergency response efforts. As technology continues to advance, further improvements in the design and capabilities of such robots can be expected, contributing to more effective disaster management and saving lives in critical situations.

REFERENCES

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