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An IoT based Human Detection Quadruped Bot for Rescue

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Abstract - *Natural calamities are the one which we can't stop. As we know the global warming increasing day by day by which the rate of natural calamities is also increased. These natural disasters led to a large number of deaths either because of people gets stuck in the remains or they didn't receive help on time. The biggest challenge faced by the rescue and search teams is to search survivors and victims in the remains. This robot presents the real- time quadruped robot technology that is capable of detecting humans after a natural or manmade disaster. The robot will assist in rescue process by crawling in a designated area and analyzing it. As the robot is small in size and also equipped with a camera module, monitoring system, and sensors to identify the existence of human buried under the ruins. Due to its legged mechanism, it can crawl easily on terrain, rough surfaces. The robot sends the data for further investigation. It is a system we believe is a need of the time and will assist the rescue team so that the number of humans gets rescued. Quadruped robot will serve as a significant requirement in Disasters.*

Key Words: calamity; crawler; disaster; quadruped; rescue; survivors; victims.

1. INTRODUCTION

Rescue search is the search for people who are in distress or in danger. Generally, the search and rescue takes place on rough or uneven surfaces. Which include mountain hilly areas and rocky surfaces.

A search and rescue operation is normally conducted on areas affected by natural disasters like earthquakes, flood etc. There are situations where a rescue team can lose the sight of a person stuck in certain rumble creating by the disasters which is why we came up with a designed of a robot which will be a help the team in such situations.

We have designed a quadruped bot for detecting people in such situations. This robot is less bulky and also provides stability with a four legged mechanism. A bot with more legs is more stables but makes it bulkier and increasing its cost drastically. We have made this robot both cost efficient stable while manoeuvring through rough terrain. The Quadruped bot requires a Wi-Fi connection to connect to the software to be able to work. It is embedded with a camera that helps in live stream making it easier to detect a person stuck under debris of natural disaster affected area like earthquakes. Due to its small size it will be able to crawl inside the voids to provide much more help for ground rescue force that drones or wheeled bots are not able to achieve.

2. RELATED WORKS

This robot is disserved into two parts for an approach of understanding – The Locomotion and Main Body.

A. Locomotion

The Movement of the robot is developed from mechanics of the following paper. The physics behind the balancing of the robot and its ability to maintain its body weight to move without losing its movement control is understood. The movement is designed by taking feedback from the following papers.

1. HEXAPOD was a bot designed by Min-Chan Hang*, Chiou-Jye Huang, Feifei Liu [1]. These bots were designed for carrying heavy weights. Since they carried heavy weights they were much bulkier in size.

Optimal Design of Quadruped Walking Robot's Leg was a Mechanism developed by Jongrib Ha, Jaegwang Lee, Yeoh Chin Ean1, Sangryong1 Lee and Hak Yi [3]. Here a stabilized design was developed for the bot to able to withstand its own weight

B. Main Body

The Main Body is designed so we are able to see a live stream as where the robot is heading towards. This is required for easily able to identify any barriers that come in the way while driving (controlling) the robot from afar. The Purpose for the robot is to crawl inside small gaps created from natural disaster to find and locate people stuck inside the debris. The following papers have helped us with the feedback for the main body design.

1. Camera surveillance car was a bot designed by

Harshitha R, Muhammad Hameem Safwat Hussain [2]. A Surveillance car designed with wheeled mechanism to able to detect people and provides faster movement in the smooth terrains.

3. SYSTEM OVERVIEW

This diagram represents the overview of the system proposed in this paper.

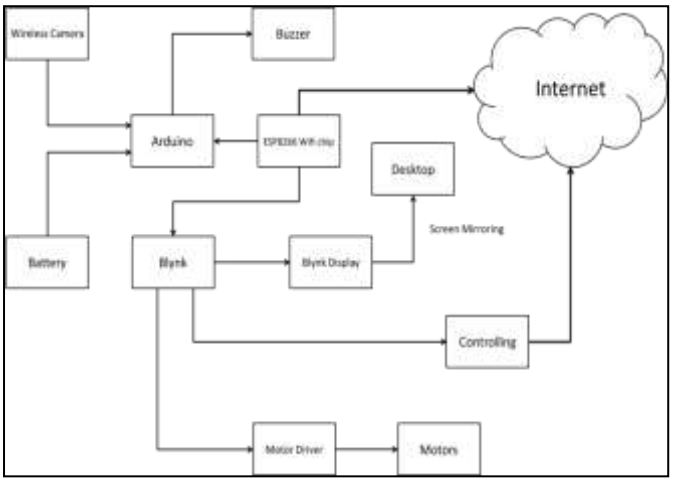

Fig -1: Block diagram of Quadruped Bot

4. METHODOLOGY

This robot presents the real-time quadruped robot technology that is capable of detecting humans after a natural or manmade disaster. The robot will assist in rescue process by crawling in a designated area and analyzing it. As the robot is small in size and also equipped with a camera module, monitoring system, and sensors to identify the existence of human buried under the ruins.

Due to its legged mechanism, it can crawl easily on terrain, rough surfaces. The robot sends the data for further investigation. It is a system we believe is a need of the time and will assist the rescue team so that the number of humans gets rescued. Quadruped robot will serve as a significant requirement in disasters.

This robot works with an application named Blynk which enables to user to control it with the help of internet regardless the location of the user and the robot. The application is able to recognize the Wi-Fi module when activated on the robot through which it connects to the robot directly.

The robot consists of legged mechanism which require coding to be able to control the walking of the robot through the application which is already been done by us.

We have designed a simple user interface which is very easy to understand and work with any type of user controlling the robot. This robot does not require the user to have any technical idea.

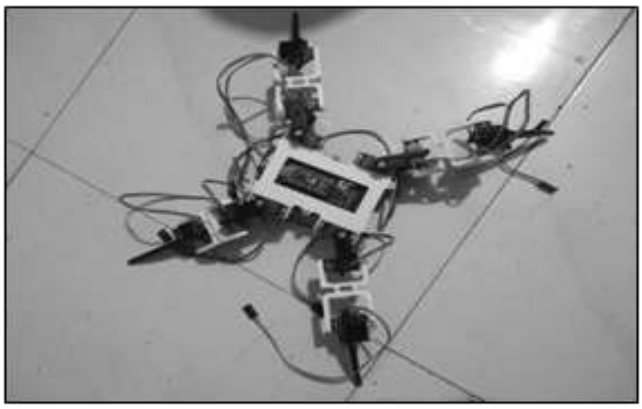

Fig -2: Quadruped Bot

5. DESIGN

The demand of legged increasing day by day. Legged robots are more advanced and stable than wheeled robots, they are mostly used on uneven surfaces such as battlefield, hilly and rocky surfaces, forest area and in areas affected by natural disaster. However, the perfect movement for robots with legged mechanism is constantly updating. The design is implemented in such a way that it can tackle any obstacle which is not possible by robots having wheeled mechanism.

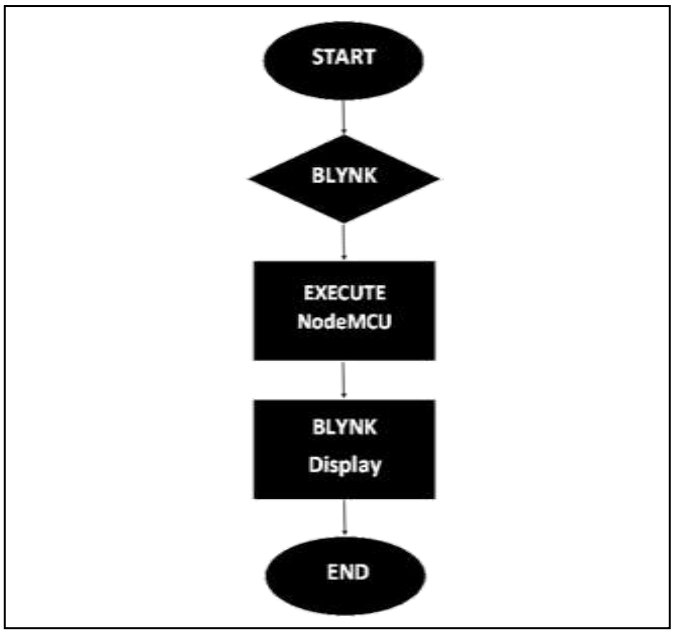

Fig -3: Flowchart of Blynk interface

Blynk app provides a simplistic interface being able to access the robot easy and manoeuvre it accordingly. It is easily able to connect to the Wi-Fi module attached to the robot and also connect to the camera to provide live stream report on the computer/mobile screen.

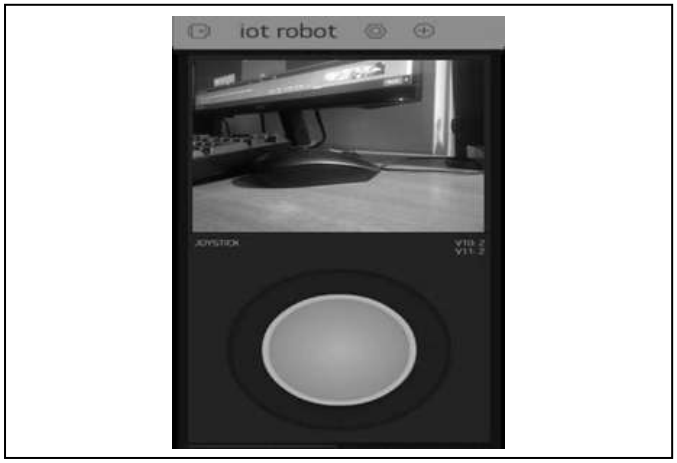

Fig -4: Blynk interface

6. FLOW CHART

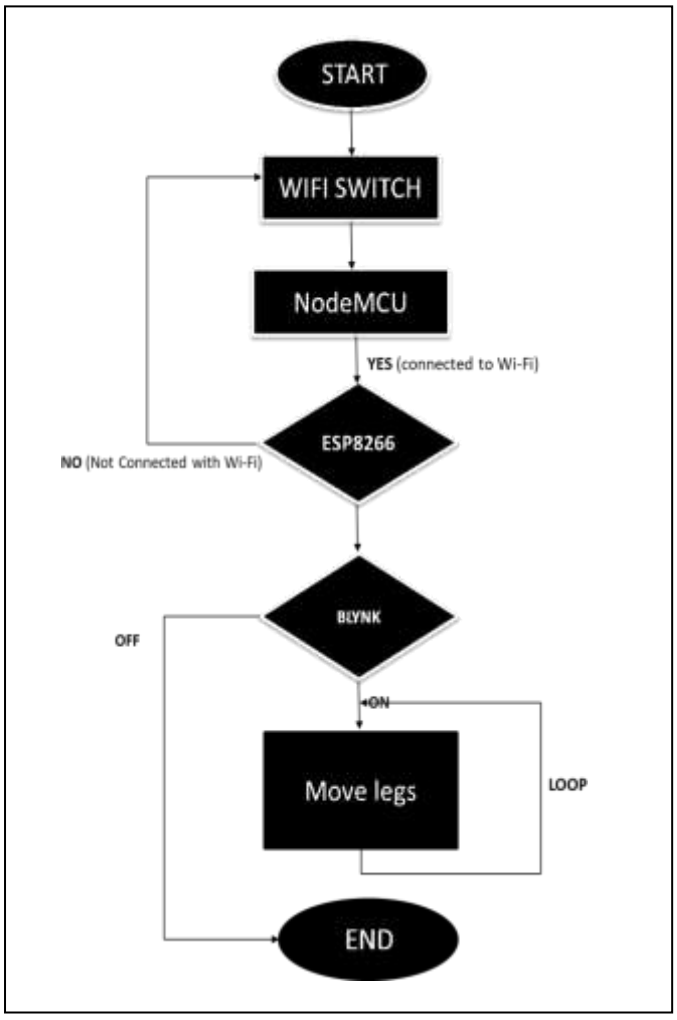

Fig -5: Flowchart for working of robot

7. COMPARISION WITH EXISTING MODEL

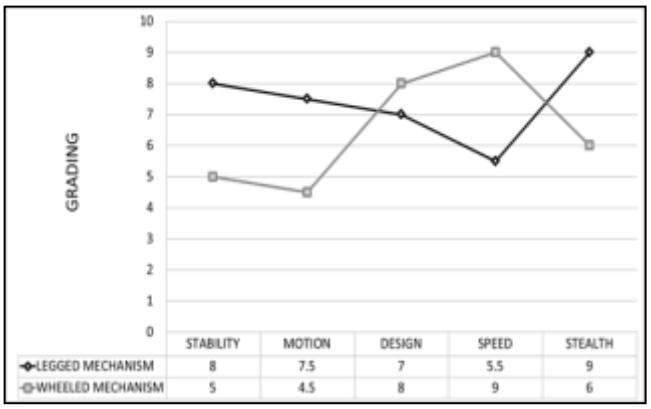

Chart -1: Graphical comparison

ROBOT TYPE	STABILITY	MOTION IN ROUGH AREA	DESIGN COMPLEXITY	SPEED	STEALTH
LEGGED MECHANISM	HIGH	MODERATE-HIGH	MODERATE-HIGH	LOW	HIGH
WHEELED MECHANISM	LOW-MODERATE	LOW	LOW	HIGH	LOW

Fig -6: Performance wise comparison

8. RESULT ANALYSIS

The previous system used a wheel mechanism which is not good for moving through rough and hilly areas. These bots are difficult to use in situations like earthquakes, floods where there is no smooth surface to move from one place to another. Weighing Robots are designed for carrying weight so they are much bulkier in size. To overcome the difficulties in previous systems, we introduced a new system in which we used a legged mechanism. Also these bots can crawl through rough hilly terrain easily without disturbing the stability. One of the essential feature of our proposed paper.

9. FUTURE SCOPE

As we can see the quadruped bot we created can be used to rescue people from disasters via live stream and buzzer alert. But this project can also be used in defense area. By this application of bot it can be used as a landmine detector as the bot is light weight and can be equipped with metal detector so that there will be no physical contact with mines.

10. CONCLUSION

Due to the problem of finding people stuck inside debris of fallen buildings or in any other similar scenario. The robot presented in this paper will be a useful asset to the

rescue team being able to crawl inside small voids and find a person requiring help. This robot is easy to maneuver over rough terrain and easy to use with a simplistic interface provided by the Blynk software.

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