Final Year Project Showcase Batch 2018
Year 2022

Department: Electrical Engineering		
Programme: Electrical Engineering		
1	Project Idea	Nearly on average 60,000 humans annually die due to disasters all around the world [1]. In initial hours right after any incident, by quick and précised rescue response many lives can be saved of victims and rescue workers. To facilitate the process and methodology of rescue operations, the tool of robotics and smart searching methodology by using sensors and computations to find and assist rescue interests at any disastrous site can be utilized in order to save the life of victims and rescue workers as to minimize the losses. Providing the actual 3D Mapping of the site, real time physical conditions, human/life and fire detection can greatly facilitate the rescue operation of unseen disastrous area. So as the title is "**DEVELOPMENT OF RESCUE ROBOT WITH SMART SEARCHING METHODOLOGY DESIGN**" [1] R. Gray, "The true toll of the Chernobyl disaster", Bbc.com, 2020. [Online]. Available: https://www.bbc.com/future/article/20190725-will-we-ever-know-chernobyls-true-death-toll. [Accessed: 03-Mar-2020].
2	Process	This design of smart robot includes both software and hardware phases. The Hardware domain of the robot includes the design of locomotive mechanism and the integration of sensors and transducers with the computational processing unit. Whereas the software domain includes the nodes connection of robot operating systems and the live data processing using algorithms to precisely detect the rescue interests, 3D mapping of the unseen / unreachable disastrous site and the real time physical situation including human body and fire detection.

3	**Outcome**	A smart robot capable of performing 3D mapping of unseen disastrous site so the rescue operation can be facilitated in terms of reaching to the important points by determining the available paths, changes in regular maps, hurdles and blockages. In parallel, having enhanced searching methodology by using physical sensors and computational techniques to find the location of life which has to be secure within particular time and also the locations of Fire which have to be extinguished, fire emerging positions, and explosives.
4	**Evidence (Theoretical Basis)**	In this project I have concluded with results that by using the OpenCV and python computational techniques which include NumPy matplot etc. type libraries we can have a detailed and reliable detection of human as getting a detailed landmarks connections of human body structure. And yet the trained model of cascade classifier can predict the similar looks of fires in live vision through the multi scale detection algorithms. When it comes to the mapping solution the robot operating system nodes structure and algorithms can be used to visualize the input images and can relate the set of images to make sense of 3D map. Also, the overall locomotion of robot will be feasible by using DC gear motors and the controlling of the robot locomotion can be feasible through IOT devices which here in case the NodeMCU in combination with motor driver IC can control the speed and direction of the robot accordingly through the IP address-based application. In last the mechanical structure can be strong enough and light weighted too at the same time by using fiber glass, PVC pipes and wooden sheet. Where the required torque and speed can be given by DC gear motors. And the combination of lithium-ion cells in series with BMS can give required power to our machine.
5	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"**	As by providing a solution to minimize the life and material losses in case of disasters situations. This project is mainly achieving the Target 11.5 REDUCE THE ADVERSE EFFECTS OF NATURAL DISASTERS. It is also related to the objectives defined in Target 11.1 SAFE AND AFFORDABLE HOUSING, and Target 11.3 INCLUSIVE AND SUSTAINABLE URBANIZATION.
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence	
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region)	**SDG#3: Good Health and Well-Being** By providing robotics support to the rescue workers in their operation, this project, achieves Target 3.9 REDUCE ILLNESSES AND DEATH FROM HAZARDOUS CHEMICALS AND POLLUTION. And by providing quick and fastest method of fire detections and unusual / abnormal events, it

d		achieves Target 3.D IMPROVE EARLY WARNING SYSTEMS FOR GLOBAL HEALTH RISKS. **SDG#8: Decent Work and Economic Growth** By providing a tool which assists the rescue workers to minimize their direct physical engagement with the hazardous site, my project also archives Target 8.8 PROTECT LABOUR RIGHTS AND PROMOTE SAFE WORKING ENVIRONMENTS. **SDG#9: Industry, Innovation and Infrastructure** By applying modern tools of computations, this project achieves the Target 9.5 ENHANCE RESEARCH AND UPGRADE INDUSTRIAL TECHNOLOGIES
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.)	By designing the responsible robotic machinery in such a way that it can reduce the level of harmful emissions produced. Moving away from traditional fossil-fueled machinery to using robots charged from renewable energy source, such as wind and light, will help reduce these harmful emissions
c	**Cost Reduction of Existing Product**	Currently there is no such product available in local market.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests)	The budget limitations, unavailability of things on shops, time required to synchronize with latest sudden changes in robot operating system and limitations of my computational hardware specially the NVIDIA graphics card have affected some physical implementations of the project for example the quality of 3D scanning can greatly improve with the graphic card. Truly the extension of the project can be told more accurately after the availabilities of more powerful hardware. Right now, at this stage it can be suggested that to extend this design, more cost and research can be added to shift the prototype machine to commercial level application by adding some more efficient sensors and specially by adding a canopy which should be able to confront the extreme physical conditions while safeguarding the electrical system of the robot. This will enable the robot to assist the rescue teams and victims in harsher disastrous environment. Also, my new findings and learnings have opened the doors to add more to the robot, for example the autonomous operation to reach any desired point of the map, the easier control by reading the gestures from the controller, the CCTVs live integrations in computational process to more accurately analyzing the objects of interests etc.
e	**Capture New Market** (e.g. Niche market or unaddressed segment)	The warehouses, malls and stores want a pre and post preventive safety tools to minimize the risk of any uncertain disaster to avoid any life or financial loss, along with a proper system which can timely notify the unwanted or abnormal action if occurring at their site.

7	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service	This robot / tool can be utilized by rescue workers in disaster management departments. And also, by military engineering departments to locate the human, objects and other things while scanning and mapping of any area. Also, the warehouses, malls, super stores, shops, residential homes and buildings etc. can utilize it for their safety and quick emergency notifications and actions.
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10	**Pictures**	
11	**Video**	https://clipchamp.com/watch/uwZEHAVl0FV