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Development of a Smart Stretcher with Arduino Based Automation for Enhanced Patient Transport

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Abstract: ***The objectiveoftheresearchistobuildaremote-controlstretcherusingan arduinowhichismountedwithanexplosive.Thecar is controlled by using a mobile app. The connection is patched using the bluetoothfrom mobile with HC05 bluetooth module connected to the arduino.The device is made versatile such that it is able to move every direction. The device boasts its versatility in moving freely and at respectable speedin allterrains with minor changes in parts. The device ismade for free movement by boring the thought of variousobstacles in various terrain and effects of weather changes. The device's main task is to rescue the injured soldier whose vital signsare down or hit by devising a route to the patient and returning inthe sameroute avoiding all obstacles.The deviceis mainly operated by using the L293D shield whichis a motor driver used to drive two motors operating the directions of the stretcher. The device moves as per the instructions given by mobile through the bluetooth module.***
The deviceiswirelesslyconnectedwiththehelpof bluetoothwhich evenhelpsinlongrangecommunication.Thistacticallifesavercan be used in rescue and save a soldier's life without risking or involving other soldier's life. This device can also be used in hospital ambulance services to transport emergency patients to the correct ICU ward faster and correctly than humans. The device detects which ICU ward is not occupiedwithapatientandfollowstheroutesettotheward. Thistacticallifesavergreatlyhelps soldierstogetout ofapinchsituationwithvery less risk by involving very less involvement.

I. INTRODUCTION

Theobjectiveofourresearchistobuildaremotecontrolled stretcher with battery and BMS. The usage of the device makes it easy to fight inharshterrains suchas roughforests wheresoldier's havelessspatial awareness, snowyplaceswheremovingis difficult and steep hills where climbing is difficult as the devicecaneasilyreachourallieswithverylesspersonal involvement. The device can be easily connected and operatedwithanymobile deviceusingbluetooth.After the bluetoothreceives command, thetwo motorsaredriven by the L293D Shield motor driver. This makes the stretcher versatiletomoveinall directions.The deviceismadesuch thatittravelsatadecentspeedinall-weatherterrainswhile carrying the injured. The stretcher body's preferred to be made using carbon fiber with a reinforcement of steel to makethestretcherstrongyetlightweightforeasytraveling. Glass material can also be used as replacement for carbon fiber but is more heavy compared. This way the stretcher can resist the blast force and also protect the soldier.

The devicecore operatoris arduino with L293D Shieldmotor driver. The output and input components are connected and operated through arduino and shield driver. The bluetooth module is connected as an input device through which the commands are taken by the arduino and shield driver. The motorsactasoutputdeviceswhichareoperatedwithL293D shield. The circuit is also connected with BMS of the actual battery to operate the main servo motor. The device ion batteriesas their power source.Weare using a pack of 18650 lithium-ion batteries of rating 3.7 voltage and 4000 mah. The batteriesareconnectedinmaster-slaveBMSformat witheach other, so the total rating is 1176 khw.

Itotal=I1+I2+...+In

Hence, I_{total}=4000+4000…=12000mah Thevoltagealltogetherremainsthesame V_{total}=14.8V

Material	Density (kg/m^3)	Tensile Strength (GPa)
Carbon Fiber (Standard)	1760	3.53
Titanium(grade4)	4510	0.55

The hospital won't need a high-power stretcher compared to military use. The hospital mainly uses ultrasonic sensors to detectobstaclesandIRsensorto detectthreshold.The stretcher

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The stretcher uses a servo motor for military purposes and dc motor for hospital purposes. The Servo motor is the latest replacementfor theA.C motor Inductionmotor. Servo motor is saidto generate higherstartingtorque andhasless back emf on high speed which consumes less battery and runs for longer duration. The battery needs to bechargedand canrunfor about 4 hours with no problem and 6 hours in low power mode. The BMSisusedtomaintainandrunthebatteryinaefficientmanner. The war may take place in an area where the temperature is not friendlycircumstanceforthebattertorun.Toavoidthisproblem BMS always checks the outer and battery temperature and maintains the heat in the circuit by running 5V throughout the circuit.

The BMS uses a master-slave format with I2C communication where everyfour slaves have 1master withatotal of 4masters. The masters are connected in a parallel manner and the slaves areconnectedinaserialmanner.TheBMSisaAImodulewhich takescareofthebatteryandthemotorcircuitandhelpsthemrun in any harsh weather conditions.

The hospital won't be needing a BMS to handle the battery as the hospital always has a room temperature and the circuit is always ready to go. The brushless dc motor is a great motor to use as it is bothsilent andproduces a great amount of power to run the stretcher. The brushless batter is able to run in reverse and forward direction effortlessly. The power ratings of varies depends on the price put on the dc motors.

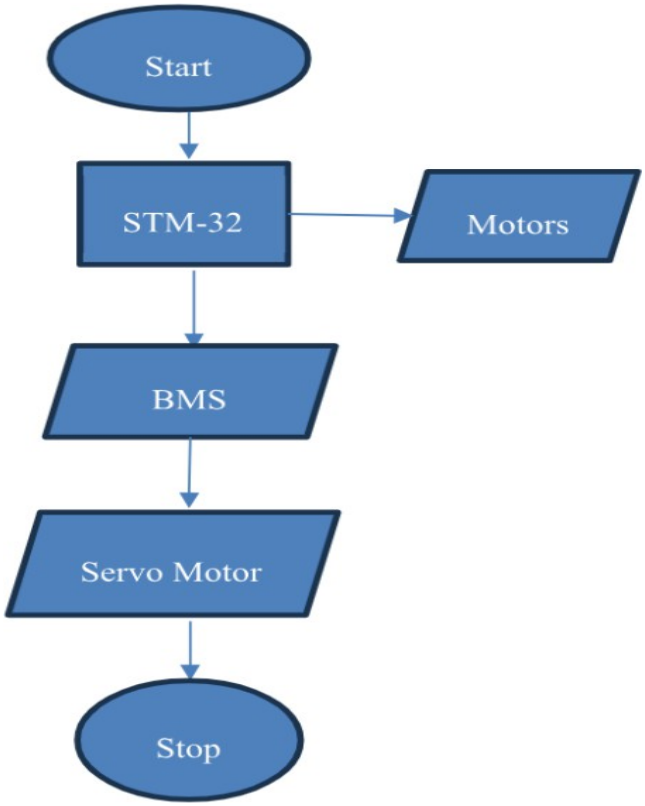


Figure1.Flowcharts ofthedrivingcircuit

II. LITERATURE SURVEY

In the research process, the team explored various papers and journals for learning the process and structure of the device. In manysituationsofwarandterroristincidents,thesoldiersare beingpersonallyparticipatedandriskingtheirliveswhichplaces theirjob sandnation securityinthreat. Totacklethisproblemthe teamcameupwiththisideaandwefirstfocusedonthetracking ofthepatient. Theteamtookreferencefrom[1]R.N.George,P.J.Zachariah,R.Mohan,M.YaseenandB.Johnandfrompapers [2] S. Sarker, M. S. Rahman and M. N. Sakib [3] M. Syedul Amin,J.JalilandM.B.I.Reaz.Thesepapersmainlyfocusedon gps detection of locationonsatisfyinga certainconditionbased bywhichthestretchercanbeoperatedtoenroutetothelocation. The team modifiedthestretcher suchthat it could perform well in all weather and terrain.

The team then focused on then focused on enrooting to the location of gps by finding the exact location through cloud and IOT applications.

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[4] R. Rishi, S. Yede, K. Kunal and N. V. Bansode,[5]S.Gatade,S.V.KulkarniandS.N,[6]P.Koganti,K. S.K,A.P,S.K.R,P.KishoreandS.R.Prasadrefer various waystodetectandenroutetowardsthegpsusingtraditionalways bysatellite communication andhumaninterference. Thismethod is rather helpful in precision basing on the remote control by human but there are some errors which can't be avoided. Therefore, the team go deep into the topic of ML and research on the topic.

[7] M.Khosyi'in,E.N.Budisusila,S.A.DwiPrasetyowati,B.

Y. Suprapto and Z. Nawawi,[8] S. Filippou etal are thepapers which helped around the way to use machine learning interface todetect andenroutethewaythroughcloudwithoutanyhuman interfacewithout any humaninteractionwhichreducesthetime taken to process the information. This could open up a lot of opportunities for further development based on the system requirements and budget put on the project.

The team focused on the main part, that is to display the audio andvideoofthecurrentlivedisplaythroughcloudnetwork.The reference of this part was taken from the previous work of the author[11]A.K.Bandani,A.Bollampally,S.Sahithi,R.Naik,

N. KumarandGoutham,theinterfaceissimilarandrequiredfor the extension of project. [9]Y.Yu and S. Lee and [10]M. R. T. Hossai, M. A. Shahjalal and N.. F. Nuri were also used for referenceastoexploreandmakeupfortheothersetbacksandto update and make a better updated model.

The team is working on making further developments by using artificial intelligence for selfdriving. By setting the coordinates of location the device would be reaching the location and performsitstaskefficientlycomparedtothatofahuman.Inthis contexttheteamispickinguppreferencesfrompaper[7]and isworkingonitsresearchtomakeitpossible.

III. PROPOSED MODULE

On taking the reference related to topic of research theteam started adlib on the on the prototype and make it possible such that the stretcher is able to move the gps location on remote control . The video quality and the audio quality are noticed to be low compared to the initially expected model. The main objective and the initial point of the protype is the gps signal. The gps sensor sends information about location of the injured soldierwhenthereisdropinhisvitalsorheisinjuredwhichcan be known by the bulletproof jacket worn by the soldier. The prototype alerts the nearby soldier to bringhim to safety. The stretcher is enroute and controlled throughremote and sent to thelocation.Afterthesoldierismounted,thestretcherreturnson thesameroutewithpacemorethanthatofahuman. Thisreduces casualties in war and helps in gaining an upper hand over the enemy.Thestretchermainlymoveswiththe helptheservomotor and the dc motors helping in changing the direction of the stretcherhelpingasagreatdrivingassist. Thestretcherisableto moveatspeedof60kmphbecauseofthepowergeneratedbythe motor. Thekeyrolehereisplayedby thecloudinterface withit's control over the sensors and alert the controller about the situation in war.

Similarly the team focused also on the alerting system as the stretchercan'tautopickthesoldier,thenearestsoldierisalerted topickandplaceonthestretcher.Thissysteminasimilarformat canalsobeusedforthehospitalemergencybutthegps sensoris replaced with ultrasonic and IR sensor . The stretcher is also equipped with IR sensor and ultrasonic senor for it follow the line and avoid any obstacles if detected. The ultrasonic and IR sensormeasurethresholdtorecognizeiftheICUward isvacant or not.

IV. RESULT

The followingpictureshowthestretcher andthehardwarecircuit oftheprototype.Theprototypeisbeingoperatedusingbluetooth simulation from our mobile asit is easierto operate and run the program and control the prototype.



Figure3:Stretcher

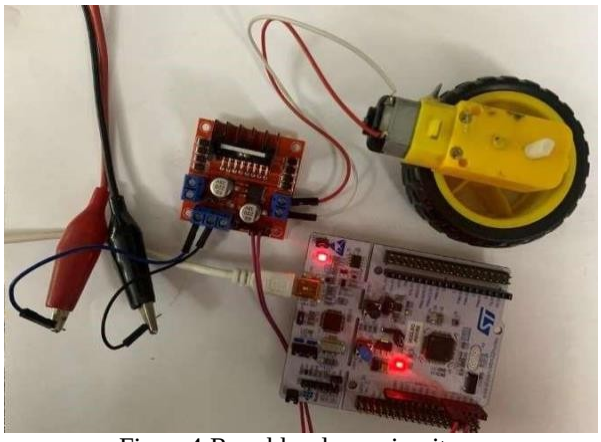


Figure4:Roughhardwarecircuit

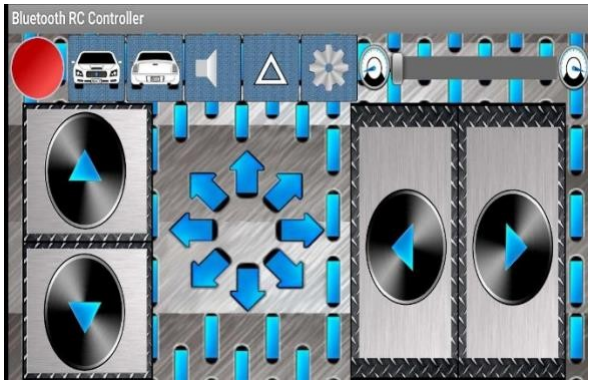


Fig.5.Simulatiom

V. CONCLUSION

As per commands the stretcher moves in all directions in versatileandspeedymannerwhilecarryingthepatientonit.The robot doesn't involve any other human interference to move or to be personally involved in the task. The protype has a lot variable options according to the demand of the user. By using AI assistant, the driving can become automatic without any human intervention and this makes the movements of the stretcher more precise and efficient. arduino is the most preferableboardforAIapplicationsinthepriceefficiency.Thisprojecthasalotoffuturescopeandisprettylowcost.Thiscould helpstrengthen ourdefenseandreducethenumberofcasualties in war and helping the heroes of our country during the high time.

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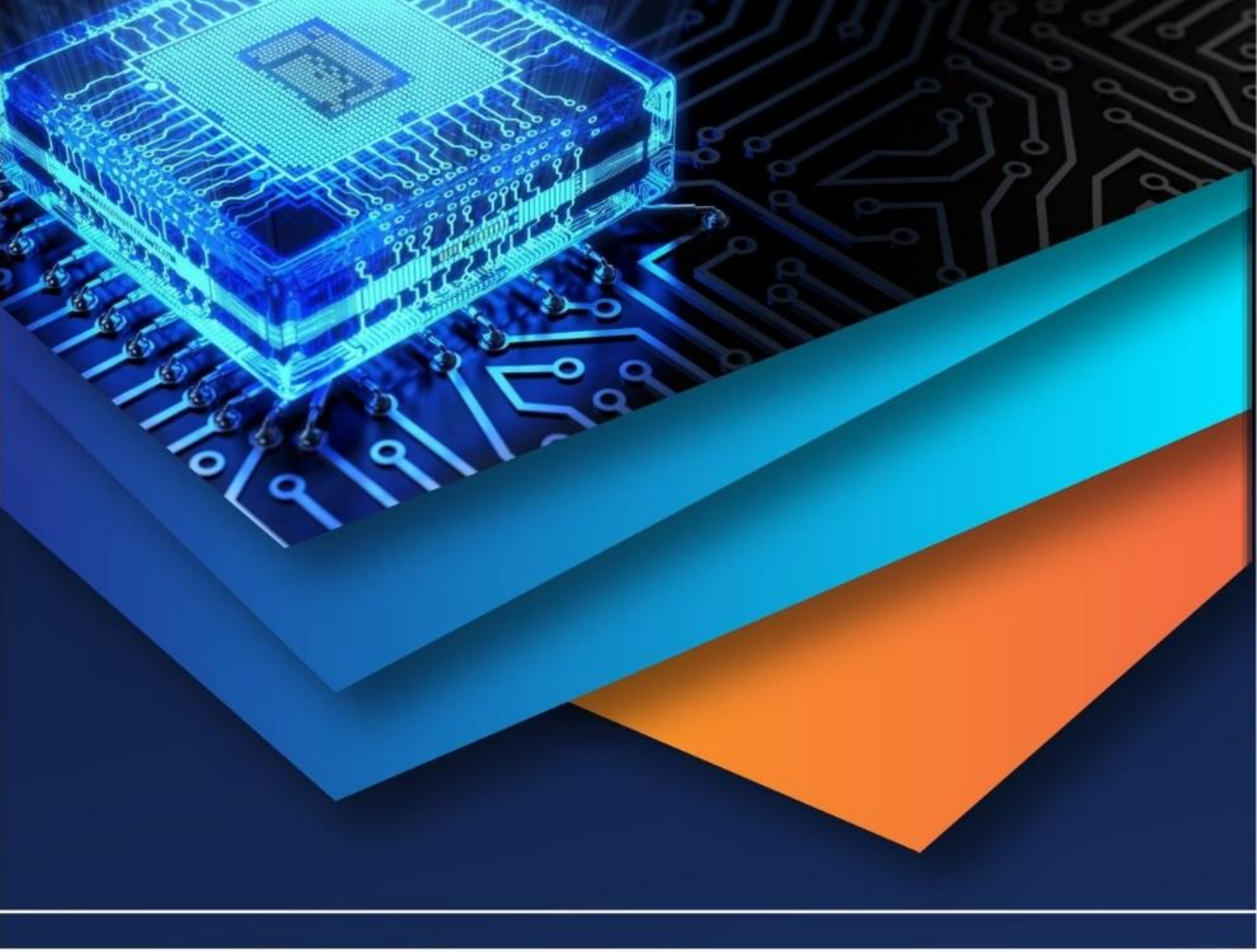
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