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Design Approach For Ambu Bag Automation

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Abstract— The main objective of this paper is improve the system and the working of the ambu bag by automation with reliable cost. Existing ambu bag system is very efficient but it has certain drawbacks which made it not much helpful the emergency conditions like pandemic Covid-19. The existing ambu bag system which can provide medical assistance to patients. It creates difficulty when there is extreme need to provide the oxygen and the patients required to move from remote area for the better medical help. Where at the earlier system was made to prevent from failure in supply of the oxygen, low level of the oxygen reservoir, the pressure of the air, here the new system is based on salving the new problems arrived the maximum time it can take to move the patients, consistency in inflating the bag and widening if making advancement. Future work is needed to achieve the potential of this approach by developing policies, updating regulations, and securing funding mechanism for the development and testing for open source Ambu Bag Automation for both the current Covid- 19 pandemic as well as for the future pandemic, for all the emergency conditions & for everyday use in low-resource settings.

A bag used to give rescue breaths for victims of cardiac arrest, used along with a face mask (bag and mask ventilation). It is an integral part of anyemergency kit. Holger Hesse andHenning Ruben introduced the concept of bag-valve-mask (BVM) 1953. There is a unidirectional valve at the patient end of the BVM. When therescuer initially attaches the bag withthe mask over the face and nostril of the victim who has stopped breathing.The rescuer then squeezes the bag and air enters the lungs of the victim. The self-inflating bag fills up on releasing the squeezing effort. The unidirectional valve prevents sucking in of expired air when the bag inflates. An Ambu Bag is a device that is needed when a person can't breathe properly or they can't breathe on their own. Ambu Bags are very important for sufferers of COVID-19 & other breathing problems and existing ventilators in hospitals are very complex & are very expensive. The availability of existing ventilators is not sufficient to meet the demand when the patients in hospitals are more dueto pandemic like situations and many countries will struggle to afford expensive conventional ventilators, and so many critically ill patients are dying because of lack of ventilatorfacility, so we need an alternative to meet the demand. In this paper we are going review methods to make an automatic ambu bag operating devicewith a simple mechanism and cost-effective.

Keywords—Ambu-bag, Ventilator, Arduino,BVM.

I. INTRODUCTION

A bag valve mask (BVM), sometimes known by the proprietary name Ambu bag or generically as a manual resuscitator or "self-inflating bag", is a hand- held device commonly used to provide positive pressure ventilation to patients who are not breathing or not breathing adequately. The device is a required part of resuscitation kits for trained professionals in out-of- hospital settings (such as ambulance crews) and is also frequently used in hospitals as part of standard equipment found on a crash cart, in emergency rooms or other critical care settings.

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Manual resuscitators are also used within the hospital for temporary ventilation of patients dependent on mechanical ventilators when the mechanical ventilator needs to be examined for possible malfunction or when ventilator-dependent patients are transported within the hospital. Two principal types of manual resuscitators exist; one version is self-filling with air, although additional oxygen (O2) can be added but is not necessary for the device to function. The other principal type of manual resuscitator (flow-inflation) is heavily used in non-emergency applications in the operating room to ventilate patients during anesthesia induction and recovery.

Use of manual resuscitators to ventilate a patient is frequently called "bagging" the patient and is regularly necessary in medical emergencies when the patient's breathing is insufficient (respiratory failure) or has ceased completely (respiratory arrest). Use of the manual resuscitator force-feeds air or oxygen into the lungs in order to inflate them under pressure, thus constituting a means to manually provide positive-pressure ventilation. It is used by professional rescuers in preference to mouth-to- mouth ventilation, either directly or through an adjunct such as a pocket mask.

One study, published in the Journal of Emergency Medicine in 2019, compared the effectiveness of manual ventilation using an Ambu bag versus a handheld bag-valve-mask device in a simulated cardiac arrest scenario. The study found that the Ambu bag was significantly more effective at delivering adequate ventilation than the handheld device, suggesting that the Ambu bag may be a better choice for emergency responders.

Another study, published in the Journal, evaluated the safety and efficacy of the Ambu bag [4] when used by non-expert healthcare providers. The study found that the Ambu bag was safe and effective when used by non-experts, suggesting that it is a viable option for resuscitation efforts in settings where expert providers may not be available.

A review article published in the journal discussed the various types of Ambu bags [5] available and the advantages and disadvantages of each. The article noted that there is a wide variety of Ambu bags available on the market, each with its own unique features and benefits, and that healthcare providers should choose the appropriate bag based on their specific needs and the needs of their patients.

II. WORKING

The Ambu has a squeezable bag, aone-way valve and a face mask.Compressing the bag opens a valve, forcing air through a mask or artificialairway into the lungs. Releasing the bag closes the valve and exhalation occurs passively through the exhalation port. During exhalation, the bag automatically refills with room airor oxygen. The cycle continues until spontaneous breathing occurs or breathing is mechanically supported by a breathing machine. With the mask pressed over the patient’s airway, airis forced into the lungs by squeezing the bag. The bag then refills itself with air when released, allowing it to return to its original shape. The bag can be squeezed out and re-inflated rapidly and repeatedly to resuscitate the patient and provide oxygen, even if thepatient can’t breathe on their own. So, the Ambu bag as shown in Figure I which is working on the automation mechatronic mechanism system where the sensor is used for sensing the oxygen level in the human body so it provide the related information to Arduino & then the driver received the necessary command to the motor to make mechanical system move and pressthe bag as shown in Figure II.

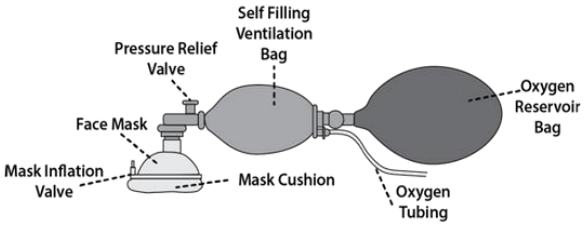

Figure I: Ambu Bag

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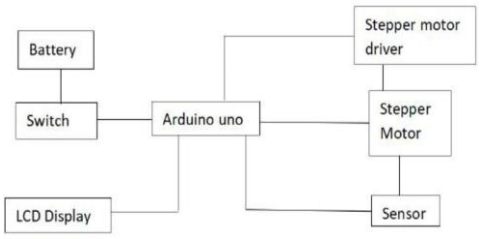

Figure II: Block Diagram

1) The function of the system starts with the switches allowto flow the power to make the system on obtaining it from the battery.
2) The potential received by Arduino makes Arduino activate.
3) The sensor also gets activate and sends the oxygen reading as an input to the Arduino, where it will measure theoxygen level present inpatient's body.
4) The Arduino then responds tothe output received from sensor & sends the command to the driver circuit of the stepper motor.
5) At the final stage with the help of stepper motor the Ambu Bag starts its function and the oxygen from the environment get pressed into a human body by the speed according to the patient's need.
6) This is how we achieve the automation in the Ambu Bag.

After assembling and carefully putting the breathing mask on the patient, the ventilation controller is started. The initial parameters such as patient'smeasured level of body oxygen that istaken as a typical input during theinitiation of Ambu Bag ventilation unitfrom the attending personnel. Accordingly, the controller sets the initial starting position of the flips, angle of rotation of motor to impart compression stroke by fiber flips withrespect to starting position, motor angular speed during compression stroke, and motor angular speed during relaxation stroke. AMBU bagshall start operating on the patient with the parameters taken as input from the sensor and the respective command from Arduino.

Conclusion

This automated Ambu Bag ventilator allow flow of volume of oxygen to be set. The paper has presented the life saving estimates that are in the context of improvement of advance ambu bag system using control system mechanism. As a conclusion, here we end it up with reliable ambu bag system for efficient supply of the oxygen, it is reachable in reality. Using Ambu bag system for efficient source of oxygen supply, it is ended up with feasible. It is more accurate with its work. Improves medical help. Lastly we would want to feature that it'd have conceivable to furnish and adapt the new advance Automated Ambu Bag system.

Future scope

The Ambu Bag, also known as a manual resuscitator, is a handheld device used to provide positive pressure ventilation to patients who are not breathing or who have inadequate breathing. Automation hasthe potential to improve the performance, safety, and efficiency of Ambu Bags. Here are some potential future scopes of automation in Ambu Bags:
Smart Sensors: Ambu Bags could be equipped with smart sensors that monitor the patient's breathing and adjust the airflow and pressure accordingly. These sensorscould also detect leaks orblockages in the system andalert the healthcare provider.

- Automated Feedback System:An automated feedback systemcould be integrated into Ambu Bags, which would analyze the patient's breathing and provide real-time feedback to the healthcare provider. The system could alert the provider if the ventilation is inadequate or if there are any other issues.

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- Automated Bag Squeezing: An automated mechanism could be designed to squeeze the Ambu Bag at a regular interval, eliminating the need for a healthcare provider to manually squeeze the bag.

- Remote Control: A remote control could be added to the Ambu Bag to allow healthcare providers to adjust the ventilation settings from a distance, reducing the risk of exposure to infectious diseases.

Machine Learning: Machine learning algorithms could be trained to analyze patient data and identify patterns that could help healthcare providers diagnose and treat respiratory conditions more effectively.

Overall, the future of automation in Ambu Bags looks promising, and these advancements couldsignificantly improve the quality ofcare for patients who require manual resuscitation.

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