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Redesigned and Automated Operation of Gang Operated Air Break (GOAB) Switch

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Abstract:- The necessity in the operation of Gang Operated Air Break (GOAB) switch is raised now, more precisely in terms of its Operation, Modification, Redesigning and making it Automatic. Since many of the linemen's and operators facing problems and finding it very difficult to travel a long distance to operate the GOAB switch. And these switches are operated using a handle and it is done manually on a ground level. These switches are situated on the Step-down Distribution Transformer provided to the consumer localities run for 11KV lines. This Distribution transformers will be located at a far distance from the Operating Stations so when there will any fault in the line at some location and that line need to be isolated for some time till it gets corrected or in case of periodic maintenance of the line or equipments that is in case of both Pre- maintenance and Post-maintenance the particular 11KV line is need to be isolated from the main system till it gets corrected. This isolation of the particular line is done with the help of GOAB switch by the linemen or the operator by going to the respective location which may be located at far away from the main station and operating it manually and then informing the helpers or the operators to carry out the maintenance this process takes lots of time. And some of the GOAB switches are now still operating in the horizontal fashion that is opening and closing of the handle in horizontal direction which takes opposing earth's gravitational force in some extent this disadvantage also gets eliminated since we have modified this mechanism and made it in vertical direction with the help of High Power Capacity Electric Actuator which can be operated automatically from any remote location with the help of Raspberry-Pi Processor. So we have redesigned, modified the operation of GOAB and made it automatic so that the operation can be performed from operating station by the operator or from any remote place by the linemen so that the maintenance is carried out fast and it will reduces the workload on the operators and the linemen.

Keywords:- *Gang Operated Air Break (GOAB) Switch, Distribution Transformer, 11KV Lines, Operating Stations, Maintenance, High Power Capacity Electric Actuator, Raspberry-Pi Processor.*

I. INTRODUCTION

Gang Operated switch comes under the classification of Air Break switch and are those used in outdoor application.They are commonly called as Gang Operated Air Break Switches because air is used as the breaking medium. Its application is for switching and disconnecting the transformer from feeder line, overhead lines and system or from distribution cables [1]. This switch is operated using a handle and it is done manually on a ground level. Once the plunger is pulled or pushed the GOAB containing male and female parts of contacts either gets opened or closed depending upon their design. They are commonly installed in the distribution network as a switching point which is located over a long distance from residential area. This creates a problem for the line men to travel at that place and operate the GOAB, in between this their money, time and energy gets wasted. Beside this the time taken for the maintenance work is not predicted and the consumers demand for uninterrupted power supply, here time plays a very important role.

The proposed system will save the journey time of the line men using modern day technology, this method of controlling the switching process of GOAB will be advantageous as the lineman will operate it whenever necessary irrespective of his or her place or location just by using his or her mobile phone or the operator operating in the station also has the provision to operate it. Signal sent from the mobile phone or from the station to the Raspberry-pi processor will analyze the signal and based on the command given by the lineman or the operator actuator will change its position upwards or downwards either pulling the handle or pushing it.

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Fig. 1:- shows GOAB having male and female contacts mounted on the insulators.

Fig.2:- shows male and female contact parts of the GOAB switch in connected position.

Fig. 4:- shows parts of the male and female contacts of the GOAB switch such as blade, contact furnished with arching horns.

II. THE PROPOSED UNIT OF REDESIGNED GANG OPERATED AIR BREAK (GOAB) SWITCH

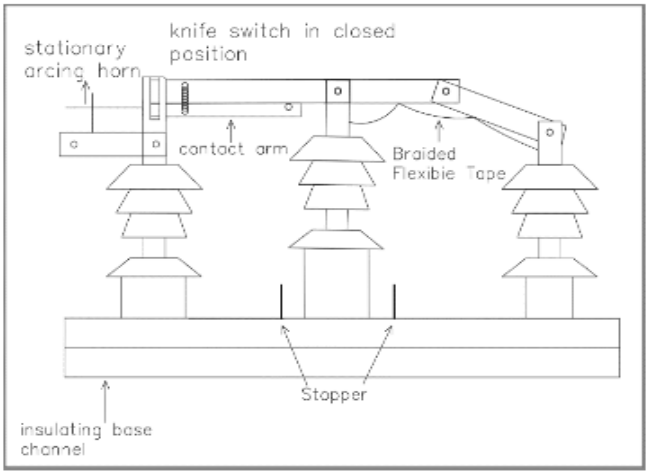

Fig. 1: showing the position of the contact, we can see both contacts are in rest position making the connection.

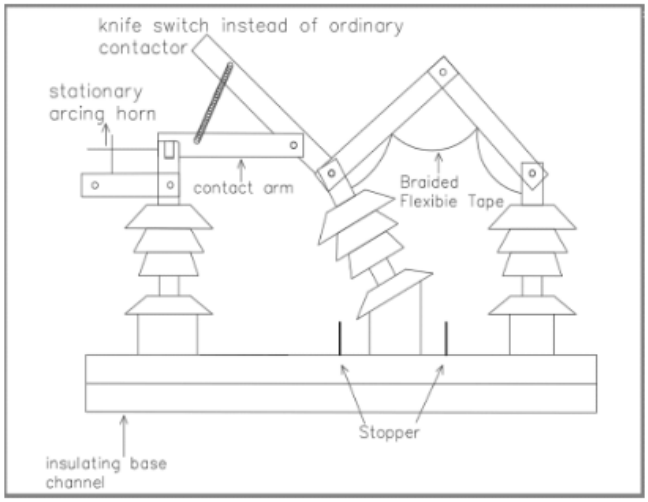

Fig. 2: shows the change in position of the upper contact pulling the lower contact with the help of spring.

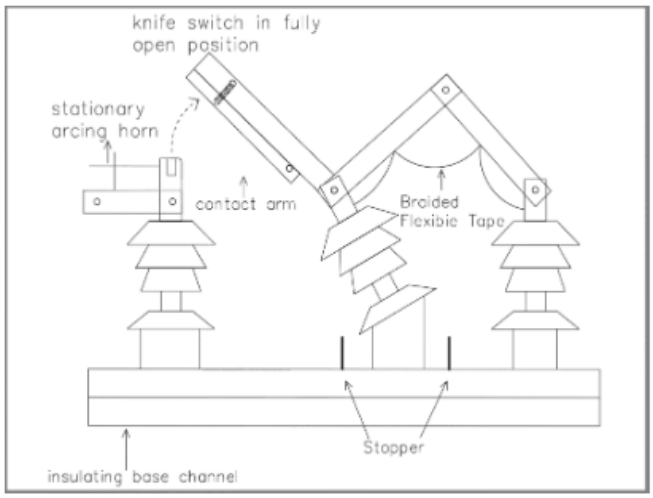

Fig. 3: shows the contacts are fully opened and the connection is not established.

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Construction of the GOAB is as simple as it is shown in the above diagrams, the contacts are mounted on the insulators, both the end contactors are stationary the second insulator has moving mechanism side ways, this is what makes the male and female part of the contacts to make and break the connection.

In Fig. 1 the second insulator is not moving as the plunger is not triggered by the handle, so this makes the insulator in the stationary position and the contacts now have established the connection of transformer and the incoming line.

In Fig. 2 now the plunger is being triggered by the handle controlled by the electric actuator so the second insulator will change its position, as we can see Fig. 2 the posture of second insulator is not as same as shown in Fig. 1. Now as the second insulator has changed its posture so will the contacts too, we can clearly see the position of the male contact (one among the two parts) has been lifted upwards. As the upper contact is lifted this creates a force on the tension spring present in between the two contacts, now this energy is used to pull the other part of the contact back together. This is shown in Fig. 3 the lower part of the contact is pulled by the tension spring and now the male contact fully opened and connection which was established in between the transformer and the incoming line shown in the above two figures Fig. 1 and Fig. 2 respectively is now detached and transformer is disconnected from the incoming line. The High Power Capacity Electrical Actuator consists of an electric motor which creates rotary motion as the rotor (DC Motor) rotates. The motor spindle is directly coupled to a helical screw via the gear box (drive shaft) which in turn rotates in a ball screw. As the spindle rotates the ball screw is driven forward or backward along the screw. A hollow piston rod is attached to the ball screw and this creates the linear motion or into the actuator as the motor rotates clockwise or anti-clockwise.

Based on the program the Raspberry-pi processor will control the moving action of the High Power Capacity Electrical Actuator by moving the hollow piston rod up or down in vertical position making the opening and closing of the contacts. This action can be controlled by the respective lineman of that particular area or by the operator from the station, which makes the operation to take place very quickly and easy and reduces the manpower required and also save the repair and maintenance time.

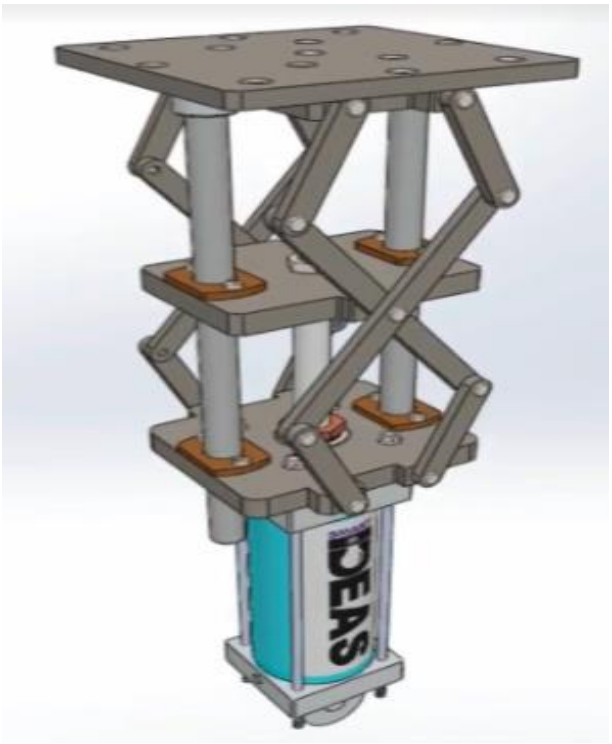

Fig 4: shows High Power Capacity Electrical Actuator which replaces the conventional manual method of handle driven plunger in GOAB switch.

III. RESULTS

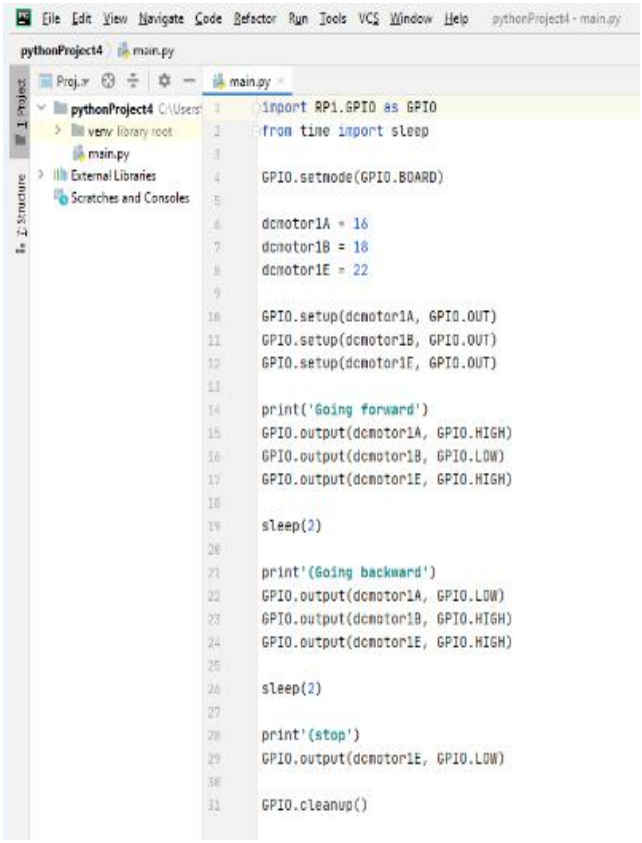

Fig. 1: Program code of the process written in the python programming language in PYCHARM Software of Linux OS which will be implemented in Raspberry-Pi Microprocessor in the Process.

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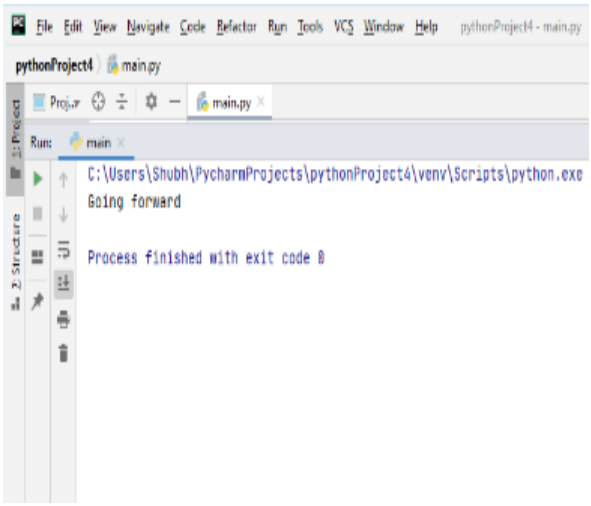

Fig. 2: Program output when the piston rod of the High Power Capacity Electrical Actuator is going forward that is closure of the contacts observed in the output console window of the PYCHARM Software.

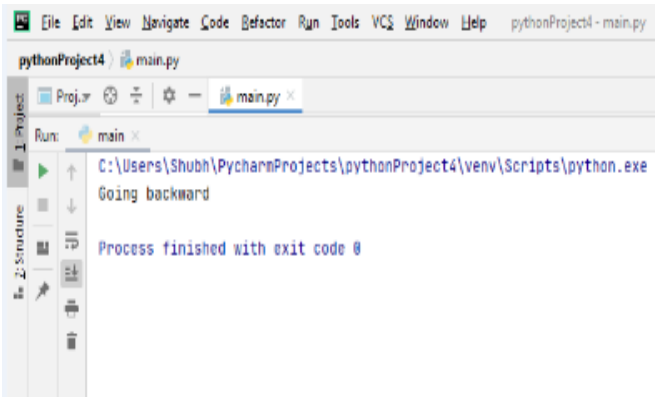

Fig. 3: Program output when the piston rod of the High Power Capacity Electrical Actuator is going backward that is opening of the contacts observed in the output console window of the PYCHARM Software.

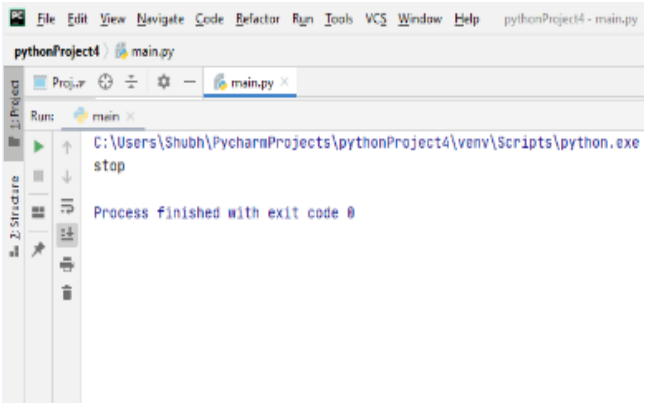

Fig. 4: Program output when the piston rod of the High Power Capacity Electrical Actuator is stopped at its position may be open or close observed in the output console window of the PYCHARM Software.

IV. ADVANTAGES

- Operator has the provision to change the operation speed in terms of time depending upon how the processor is programmed.
- The system is highly accurate & reliable.
- The system is precise to use for GOAB operation, future modifications and maintenance in the electrical distribution lines.
- The proposed system can carry out the maintenance and repair work very quickly.
- With the help of the proposed system lots of maintenance & repair time can be saved.
- Proposed system can reduce the required manpower.
- In the designed GOAB we are replacing the manually operated handle driven contact plunger with electrically operated automatic actuator contacts which is having more life and more robust in construction as compared to the plunger.
- No need of skilled operators.

V. DISADVATNTAGES

- If there is some malfunction in the Processor, the system may misbehave. But chances of occurrence of such misbehave is almost nil.
- Proper lubrication is required in the contacts of the High Power Capacity Electrical Actuator.

VI. CONCLUSION

The Redesigned and Automated Operation of Gang Operated Air Break (GOAB) Switch is having several advantages over manually operated handle driven GOAB switch as it provides quick operation of the opening and closing of contacts of GOAB switch and makes maintenance and repair work to be carried out very quickly within short period of time. The proposed system reduces the manpower required and saves the travelling time and money of the lineman by using High Power Capacity Electrical Actuator which is operated from remote places and also from the operating stations according to the program by the operator by using Raspberry-pi processor. So that the maintenance and repair in the distribution lines is carried out as quickly as possible providing consumers an uninterrupted supply of electricity. And also, we can improve the whole power scenario.

REFERRENCES

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