DEVELOPMENT OF AN AUTOMATIC SMART MILKING MACHINE USING ARDUINO CONTROLLER.

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ABSTRACT
The milking machine is a nearly automatic machine installation for milking cows. The system consists of the cluster, a milk tube, a pulse tube and pulsator, a vacuum pump, flow sensor, milk flow detector and perhaps a recorder jar or milk tank that measures yield. Together, the system allows milk to flow into a pipeline in preparation for shipping to a milk bottle or milk tank. In this operation, milk is drawn from the cow's teats by forcing the milk through the teat canal when the vacuum is created. The pulsator alternates the pressure, first creating a vacuum to suck the milk **(milk phase)** and then applying air which causes the flexible liner in the cup to collapse and massage the teat **(rest phase).** The alternating process of milk-and-rest is continued in a rhythmic pattern for the cows' health and good milk productivity. The remote control based automation circuit using android application will be connected to the milking machine using arduino controller. This is used to on/off the milking machine.

Keywords: Arduino UNO, HC-05 Bluetooth Module, Vacuum Pump, Milk Flow Detector

INTRODUCTION
Milking machines are used to suck the milk from cows when manual milking becomes inefficient or labour intensive. The ultimate aim of this project is to reduce the death and diseases due to use of compressor in the milking machine. To overcome those disadvantages, the vacuum pump with varying pressure level(40 to 50 kpa)can be used instead of compressor which has high level (sucking)pressure. The milking machine is also modified by adding a feature called milk flow detector and automatic cluster removal system. The principles of milking machine were established many years ago and the basic method described below, is used in virtually all commercial milking machines although some minority modifications are made. Automatic detacher unit that connect loosely to the milking claw allow cows to move and shift freely during milking. Based on the rate of milk flow, the detacher can also detect the end of milking, shutting the vacuum and actually removing the claw from the cow automatically. The use of automatic identification systems, such as electronic transponder cow neck- tags, have enabled dairy farmers to keep track of milk production by individual cows in large scale dairy farms. The electronic transponder cow neck-tags includes all the information about individual cows like whether the cows are ready to harvest the milk or not. The remote control based automation is used to turn off the vacuum pump after the cluster is removed by detacher unit.

MATERIALS AND METHODS
Here, The project is to develop the milking machine along with remote control based automation using arduino controller to harvest the milk from the cows. The Hardware and software components required for the project are discussed below.

Hardware used
The Hardware components such as 12v DC Adapter , Vacuum pump, Milk Bottle or Milk tank, Milk and Vacuum tubes, Milk Flow Detector, cluster assembly, pulsator, Arduino microcontroller, Relay board module, HC-05 Bluetooth module, 16*2 LCD Display are used. The input is given through the 12v DC Adapter. The Vacuum pump is used to extract the air from the milking machine. Here, The Vacuum pump

is Impulse type vacuum pump which removes the gas molecules from the air and create vacuum wherever required in the machine. Most milking machines operate at a set vacuum level between 40-50 kPa. This is sufficient to extract milk out of the teats. The Milk bottle or tank is used to store the milk. The Milk Bottle or tank should need a little space between the milk stored and the top the bottle to prevent the milk to not to enter into the pump. The Milk tubes are used to collect the milk from the cluster to the milk bottle or tank. The pipeline diameter is dependent on the number of milking units, the milk speed, the length and slope of the pipeline, and the air inlet. The vacuum tubes are used to provide vacuum and air alternately to the teats of the cow to provide a massage to the udder and to suck the milk in the healthy manner. The pulsator is used to provide the milk phase and rest phase which is similar to manual milking procedure. The milk flow detector activates the cluster removal equipment when the milk flow from the cow becomes less than 0.2 kg/ minute for a period varying from 15 to 30 seconds. Cluster assembly usually consist of three to four teat cups. The cluster assembly is attached to the teat of the cow to suck the milk. Arduino Uno is an open-source microcontroller board. It consist of 14 digital input/output pins, 6 analog inputs. It is operated with 16 MHz crystal oscillator. Pins Gnd and Vcc of bluetooth module are connected to Gnd and +3.3v of arduino Board respectively. HC-05 Bluetooth module has 8 pins. They are Enable/key, Vcc, Ground, Transmitter (Tx), Receiver (Rx), State, LED, Button. The module runs on 3.3v to 5v power supply. This Module is used to connect our mobile with this automation circuit through Bluetooth. The Relay board consist of array of 4 relays and it acts as switches. Relay allows you to turn on or turn off a circuit using voltage and/or current. Its get activated using 5v from arduino, which in turn control the milking machine.

Software used
The software program for the automation circuit is written in arduino programming language called processing. Arduino Uno is programmed using Keil MDK software. It is the industry-standard toolchain for all embedded compatible devices. MIT App inventor software is used to create the android app named as 'Bluetooth module CI'.

Procedure
In this project, the milking machine developed along with the arduino based automation. The input for the milking machine is given through the 12v DC Adapter. The 12v DC Adapter has 110-220v AC input and it provides 12V DC output, which is given to the vacuum pump of the milking machine. The function of the vacuum pump is to rapidly extract air continuously from the milking machine system. Most milking machines operate at a set vacuum level between 40-50 kPa. This is sufficient to extract milk out of the teats. Under normal weather conditions the atmospheric pressure is about 100 kPa. Here, The vacuum pump is impulse type vacuum pump. Its function is to remove the gas molecules from a sealed volume and leave a partial vacuum behind. An air/vacuum pipeline connects the vacuum pump to all the parts of the system where vacuum is required and is together with the vacuum pump regarded as the lungs of the milking machine system. Cluster assembly consist of teat cups is attached to the teats of the cow through the claw, which is used to collect the milk from the cow and convey it to the milk bottle. Milk tubes or pipelines are used to convey the milk from the milk clusters to the milk receiver. The pipeline diameter is dependent on the number of milking units, the milk speed, the length and slope of the pipeline, and the air inlet. The milk tank should not be filled too full, a little space is needed to prevent the milk going into the pump. These components are connected together and then milking machine is ready to harvest the milk. The cluster removal sequence is mostly initiated by a milk flow detector. The milk flow detector activates the cluster removal equipment when the milk flow from the cow becomes less than 0.2 kg/ minute for a period varying from 15 to 30 seconds. Now, the remote control based automation using android application to be connected with milking machine for on/off purpose. The components for automation consist of Arduino Uno board, Relay board module, HC-05 Bluetooth module, LCD are
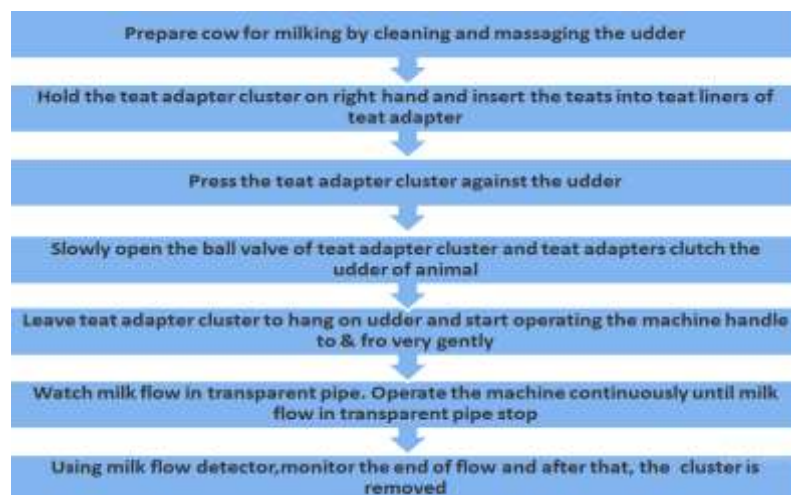
connected together and to be connected with the milking machine. With the help of android application named as 'Bluetooth module CI', the milking machine can be on/off.
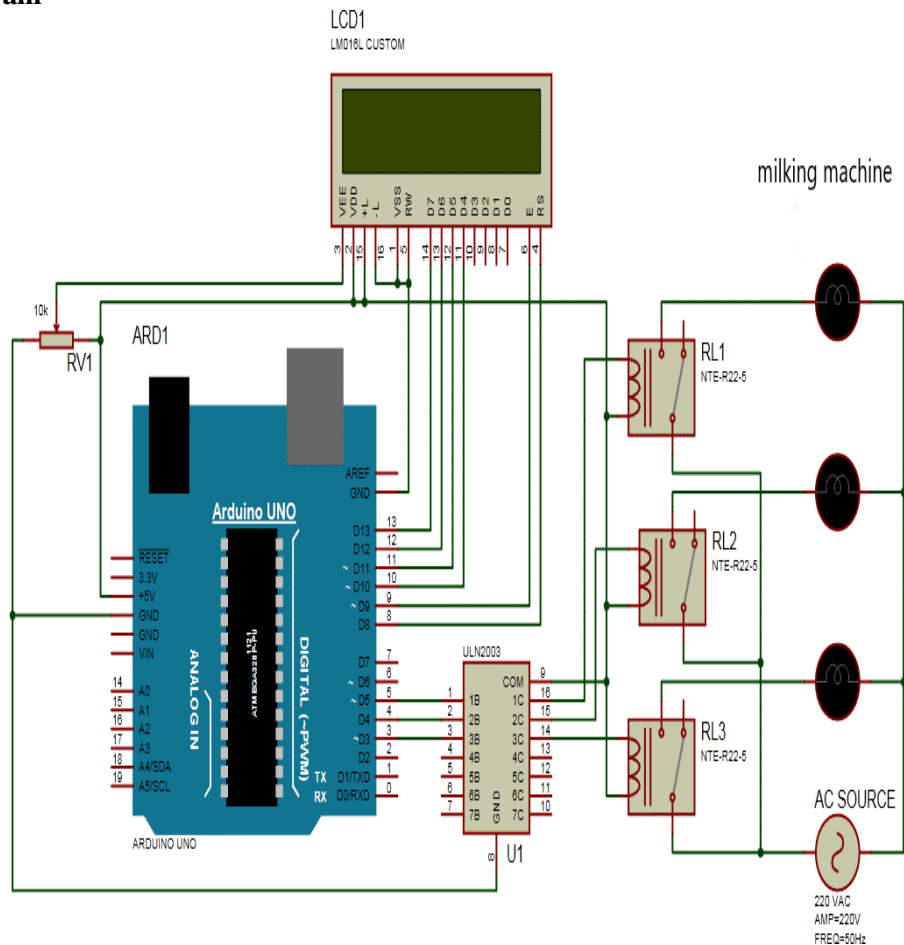

Block Diagram
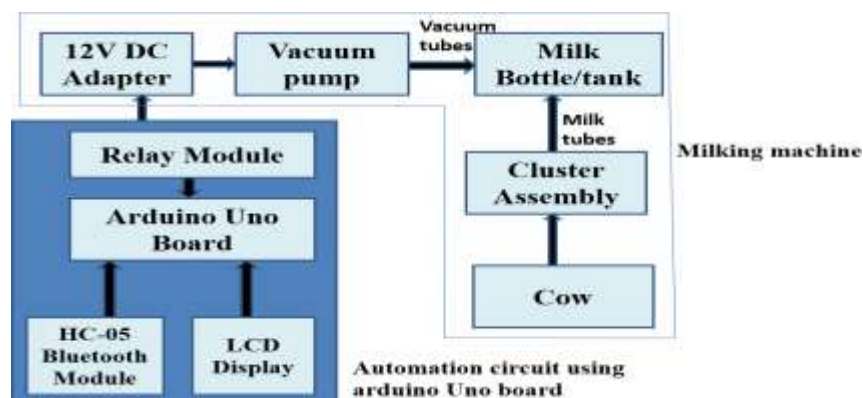
Flow Chart

Circuit Diagram

RESULTS AND DISCUSSION

The goal for this project is to develop a milking machine along with remote control based automation using android application with the help of arduino. This project provides the method to reduce the death

and diseases due to high level suction pressure provided by the compressor is replaced by vacuum pump. And also this methodology offers us the advantage of automatic cluster removal(ACR) which is done by

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milk flow detector. After the cluster is removed automatically, the machine will be turned off by the Bluetooth module CI app with the help of arduino Uno. In the existing system, the components like clusters, milk tubes, pulsating tubes and pulsators, compressor were used. The compressor gives more pressure to the cow constantly. That system causes the diseases or the earlier stage death to the cows. Furthermore, the cluster assembly needs to remove manually and the milk flow must be monitored continuously.

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