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**VISVESVARAYA TECHNOLOGICAL UNIVERSITY**

**Jnana Sangama, Belagavi - 590018**



**Synopsis on**

**“MEDICAL BED WITH INTEGRATED TOLIET SYSTEM”**

(This Project is sponsored by KSCST 46<sup>th</sup> Series of Student Project Programme  
(Project Reference Number: 46S\_BE\_0649))

Submitted in partial fulfillment of the requirements for the award of the degree of

**BACHELOR OF ENGINEERING**

**in**

**ELECTRONICS & COMMUNICATION ENGINEERING**

**by**

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- **Project Reference no** : 46S\_BE\_0649
- **Title of the Project** : Medical Bed with Integrated Toilet System
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- **Keywords** :Patient Monitoring system , Medical Bed , Integrated Toilet System, Patient Care, Mobility Impaired Patients.

## INTRODUCTION

A recent report shows that the world population is ageing, and the growth of the ageing population is the fastest. The number of people over 65 is likely to increase from 702.9 million in 2019 to 1548.9 million in 2050. Many of these ageing people would be bedridden due to age-related mobility issues. In addition to age related problems, many people are bedridden due to various diseases, accidents, surgeries, and other health issues. The bedridden patients need full-time care and attention. Family, friends, nurses, and other professionals provide this care and attention. Such patients need assistance for various frequently performed (more than ten times in a day) tasks such as invasive procedures, maintaining hygiene and patient comfort, mobilization in bed, and feeding <sup>[1]</sup>

The frequent assistance needed in all these tasks also results in embarrassment, discomfort, and loss of dignity for the patients. The caring tasks generally involve the lifting of patients or other movements. As reported manual handling of patients is one of the major causes of musculoskeletal disorders in the nursing staff and caretakers. Bed feeding to the patient, hygiene, and care had a dominant effect on low back pain. A study revealed that health care professionals working in homes for the elderly, rehabilitation centers, orthopedic and surgical departments where manual handling of patients is the main activity, are more at risk to have the spinal disease <sup>[3]</sup>.

From the above discussion , it is clear that there is a definite need to provide a special equipment for bedridden patient care to minimize assistance required for the patients and also to make patient comfortable , prevent bedsores and other musculoskeletal disorders.

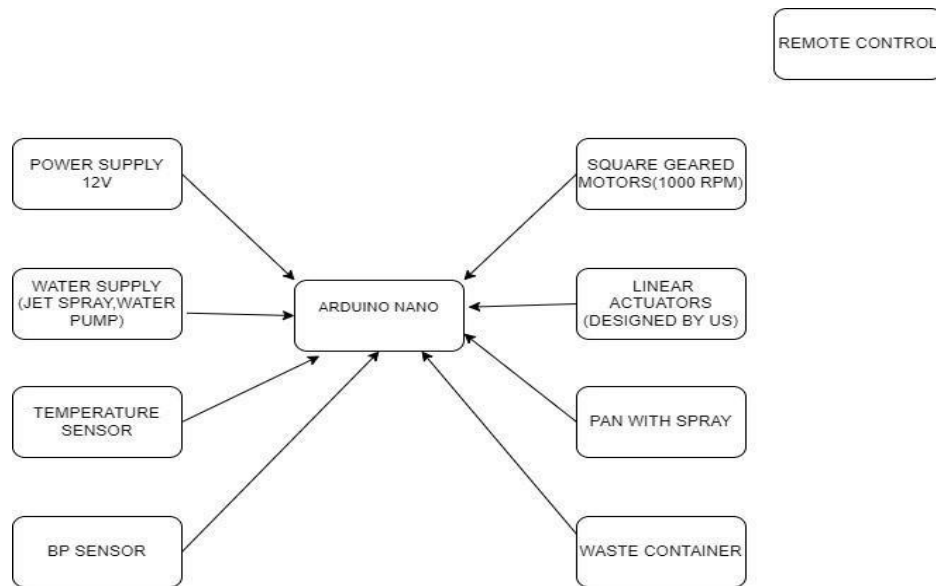
## OBJECTIVES

- To develop a new bed with integrated toilet system with adjustable bed for better excretion care for bedridden patients, aged people, physical challenged patients.
- To urinate and defaecate without the help of caretaker.

- To reduce back pain, joint contractures, many diseases caused due the bed excretion of patients and aged people
- To make patients or aged people to come over from the state of depression.
- To provide a inbuilt commode system, which provides clean and comfortable mechanism to the patients and also helps in excretion of patients. It would allow for efficient and easy cleaning, reducing the risk of infection and maintaining a clean and healthy environment for the patient
- Safety: An integrated toilet system would reduce the risk of falls and injuries associated with using a separate bathroom

## **METHODOLOGY**

- The project which we are aiming to do primarily consist of controller, power supply, water supply, motors, hydraulic, pan with spray, waste container, sensors and remote control.
- So our project aims in building inbuilt toilet mechanism to the bed so that old aged people or anyone who has certain health problems helps them to use this type of medical beds.
- At the center of the bed, beneath we will be placing the commode which has got opening in the bed. A mattress on the platform of the bed will cover the commode opening, after the use the commode is pushed back to its original position below the bed. Then the commode opening gets covered.
- The bed has got sleeping positions, chair positions and certain adjustment position and this entire mechanism is done by using hydraulic concepts.
- The entire mechanism works on the controller, so when the patient press the remote the controller opens up the bed to the sitting chair position and the mattress on the bed opens.
- So once the patient is done with his toilet, with the help of pan spray the water is supplied and again the commode goes down and mattress on the bed covers up.
- So along with this we also attach waste container to commode, so all the waste of a person gets collected into this container and which can be further used as fertilizers for agriculture and other purposes.
- Along with this medical bed we will be using sensors which monitors the patient's health (temperature, bp etc...) and this mechanism is done through use of controller.



**Fig 1 : block diagram of the proposed system**

## MAJOR COMPONENTS USED

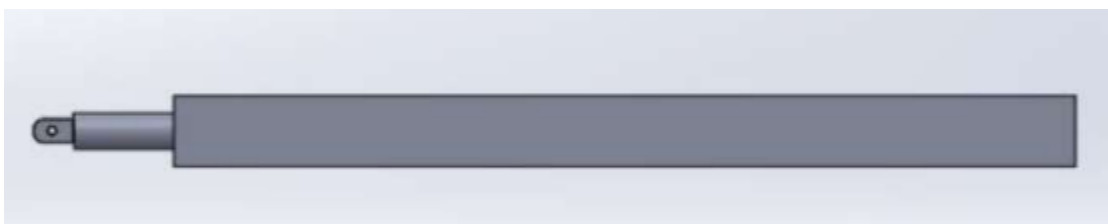
1. Arduino Nano
2. Square Geared Motor (1000 RPM , 12v DC , 2.5 Amps)
3. Pulse Sensor
4. Temperature Sensor (DS 18 B20 , Polymer Capacitor Type )
5. HC-05 Bluetooth Module (2. 4 GHz ISM Band )

## IMPLEMENTATION

### 1. ACTUATOR DESIGN

Since we are adopting inhouse build actuators. The actuators are designed using spiral rods, square geared motors and limit switch for pausing the actuator at a certain limit.

The Computer Aided Engineering Drawing (CAED) of actuator design is shown below .



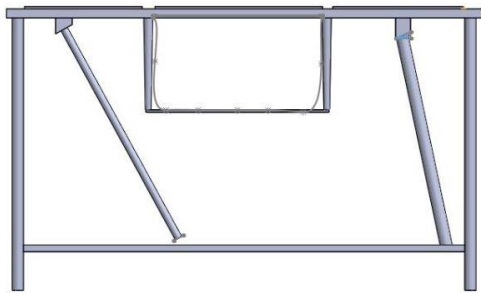
**Fig 2 : Front view**

## SPECIFICATION

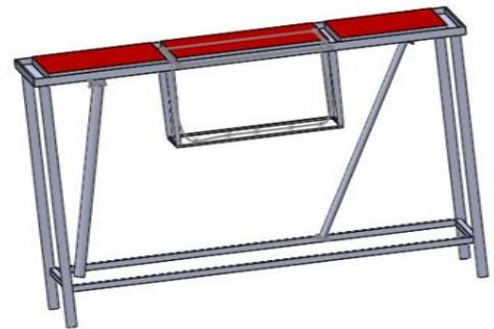
- To design the linear actuators, we have used spiral rods and nuts of 8mm.
- Along with this we have used steel pipe of 10mm to cover the spiral rod rotation.
- At a certain level and height of spiral rod, Limit switch is used to stop the actuators at that particular point.
- The actuators can be moved in both forward and reverse direction. In forward movement the bed is moving up and during the reverse direction the bed will come to its original position.

## 2. BED DESIGN

This smart bed consists of three positions: Sitting position, Lean position and Sleeping position. To design this type of smart bed we have used L angle rods, ply wood etc.



**Fig 3 :Front view**



**Fig 4 :Side view**

## SPECIFICATION

- We have designed the bed of 38'' x 18''x18'' (LxWxH) by rods, L angle and hinges, and completed the welding process.
- The bed consisting of upper part, middle part and lower part. The upper part having a size of 22'' x 18'' (LxW), middle part of size 4''x18'' (LxW) and lower part of size 12''x 18'' (LxW) and it is made by plywood sheet.
- Therefore, this bed can be lifted using actuator mechanism. So, the patient can press the remote which is placed near to him.
- The use of this bed will result in less effort for managing bedridden patients.

### 3. CONTROLLER DESIGN:

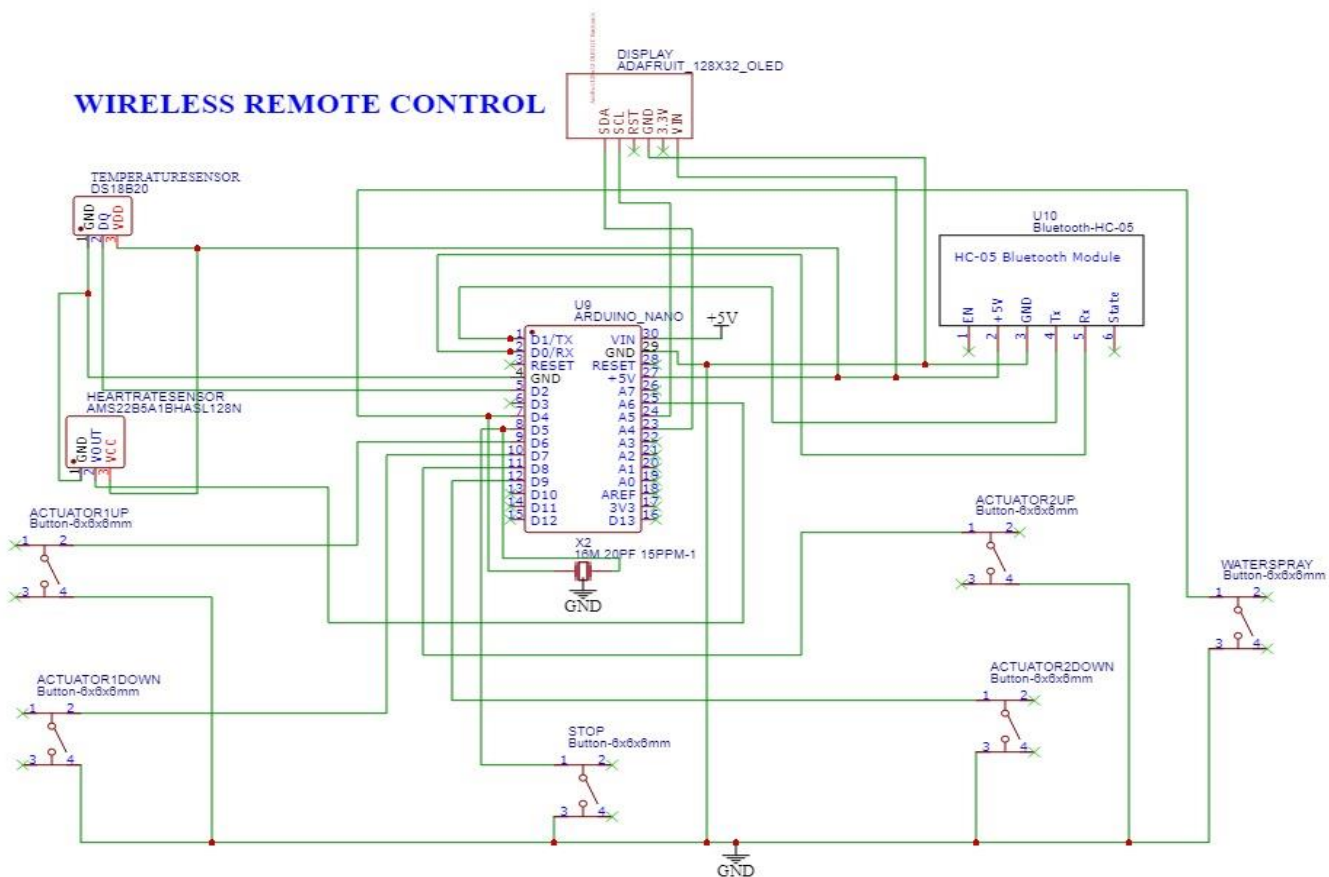
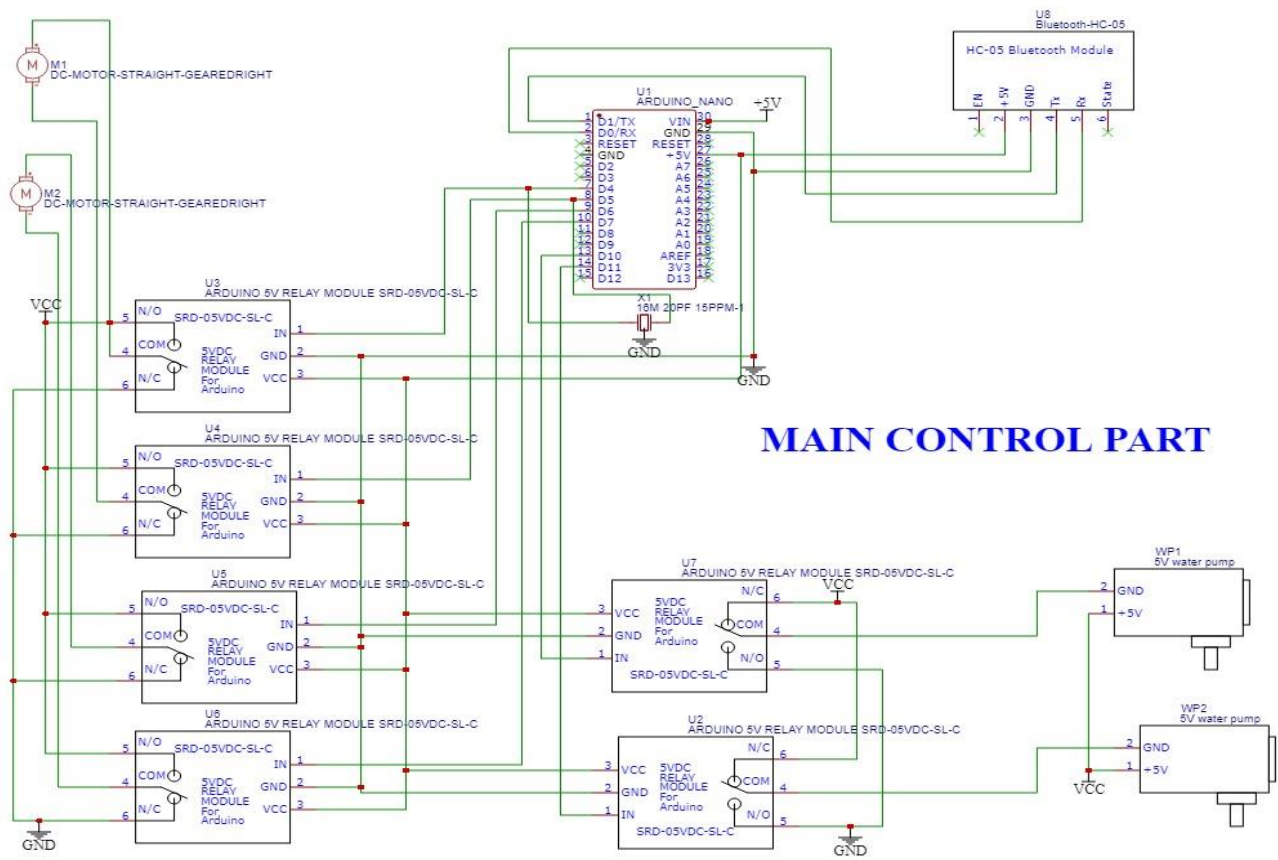
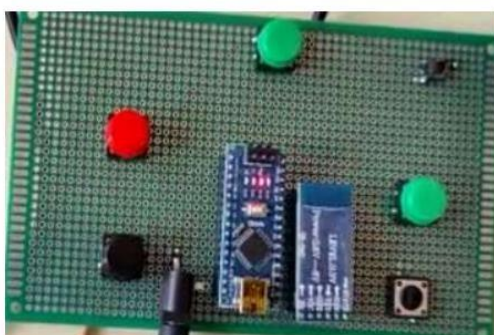


Fig 5 :Controller Circuit

## EXPERIMENTATION RESULT

- Developing of this type of smart beds can help the aged people and other physically challenged people.
- This bed system also helps to monitor body temperature, BP of the patients.
- Since the system is in built with actuator, pan with spray, and waste container, the waste disposal of a patient is done efficiently.
- The use of this bed will result in less effort for managing bedridden patients. As the patients do not need to use a bedpan, all the problems associated with a bedpan are avoided.
- This entire system controlled automatically through microcontroller it is a user friendly and reduces the effort of caretakers.
- Since we are adopting inhouse build actuators the design cost is less also the final product can available at less price to the customers. Poor/middle class people also can offer it.
- The patients or aged people can overcome from the state of depression.



**Fig 6 : Implemented Medical Bed With Integrated Toilet System along with Remote**

## CONCLUSION

The main purpose of this project is to solve the issues related to health domain especially related to aged people and bed ridden patients. The medical bed comprises a multi-positional support surfaced. It includes the upper segment part which support patient head, back, neck. Lower segment part, which supports patient lower legs and central segments used for the excretion. A commode is fixed beneath the bed in alignment with the formed opening. The entire mechanism is connected to controller part which controls the whole process. Similarly, the wireless remote is interfaced with controller part to access the required conditions automatically. The bed provides the functionality of automatic control to the patient for his excretion. Also, sensors like Blood Pressure, Temperature are used to monitor the patient's health and the readings are displayed in the LCD. This invention can support aged people or any bed ridden patients. The bed may be employed for use in hospitals, private home etc.

## FUTURE WORK

With respect to the future work, fall detection sensors, other patients body monitoring sensors and safe disposal of excretion can be implemented in order to enhance hygiene and safe care taking.

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