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Design of Mattress Compatible for MRI/CT Scans

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I. INTRODUCTION

Humans normally maintain a body temperature of 37°C, but we know in specific scans like CT/MRI/PET scan exam rooms the temperature needs to be maintained at around 18°C to 22°C. Here the body temperature and room temperature don't match this leads to the negative or minor incorrect outcome. There-fore we have to design a mattress which is fully compatible for MRI scans. This will allow us to set the mattress temperature in between the range of 20°C to 40°C. It will mainly consist of devices like fluid pump, temperature sensors, multipurpose heat pump, micro controller and many other such devices.

II. METHODOLOGY

The mattress has dimensions as (2 x 0.42) meter. It has two openings: one for the inlet of water and the other one for the outlet of water. The mattress is designed in such a way that it allows the water to flow through it and eventually making the mattress warmer on the outside that is the surface, where the patient's body will rest. The temperature of the mattress can be adjusted according to the user or the requirements of the staff in between the range of 20°C to 40°C with the help of provided input keypad. TS1 and TS2 are the temperature sensors which are placed at the inlet and the outlet of the mattress respectively to sense the temperature of the fluid. The mattress is designed with the smart mechanism that it automatically heats the water when the once set temperature by the user falls down. The heat pump, temperature sensors, relay, cooling pump and input keypad are interfaced with the microcontroller.

III. MODELING AND ANALYSIS

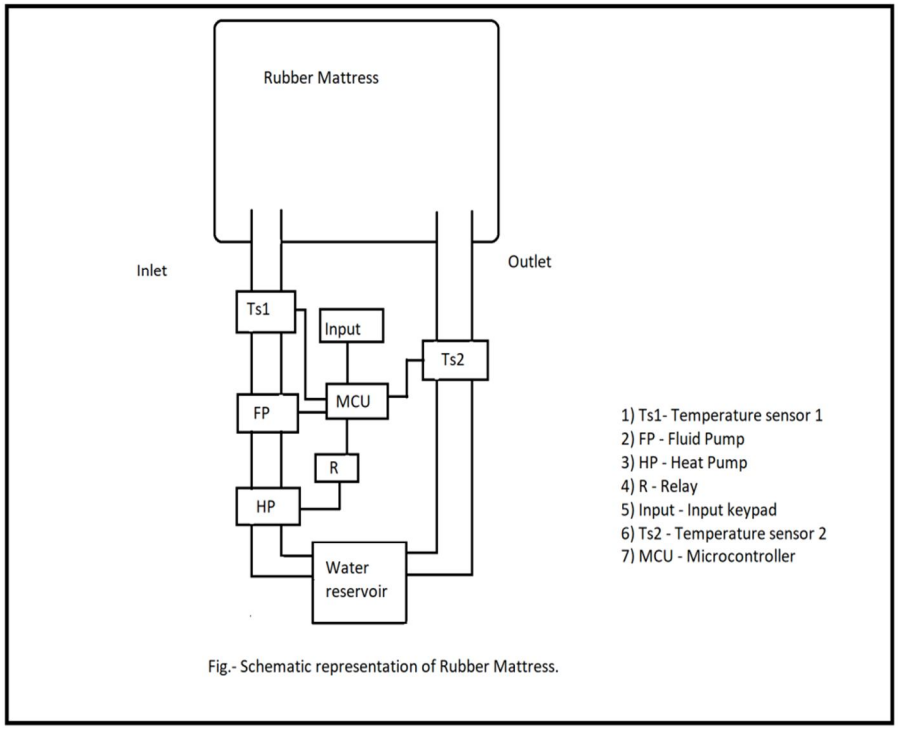


Fig.- Schematic representation of Rubber Mattress.

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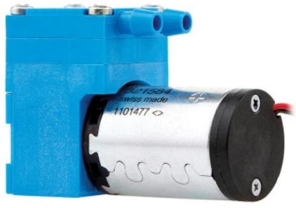
Technology	Stack
Micro controller	Node MCU/Node32/Arduino
Plastic tube [for inlet and outlet]	SY CE RoHs plastic pipe
Fluid pump	Stainless steel fluid pump 140 LPM
Multipurpose heat pump	AVI-WHH-25LDX Horizontal heat pump
Temperature sensors	DS18B20 sensor
LCD Display	Locally available
Temperature input key pad	4*4 matrix keypad
Matress material	Rubber
relay	Local relay



Node MCU



Temp. Sensor



Fluid pump

IV. RESULTS AND DISCUSSION

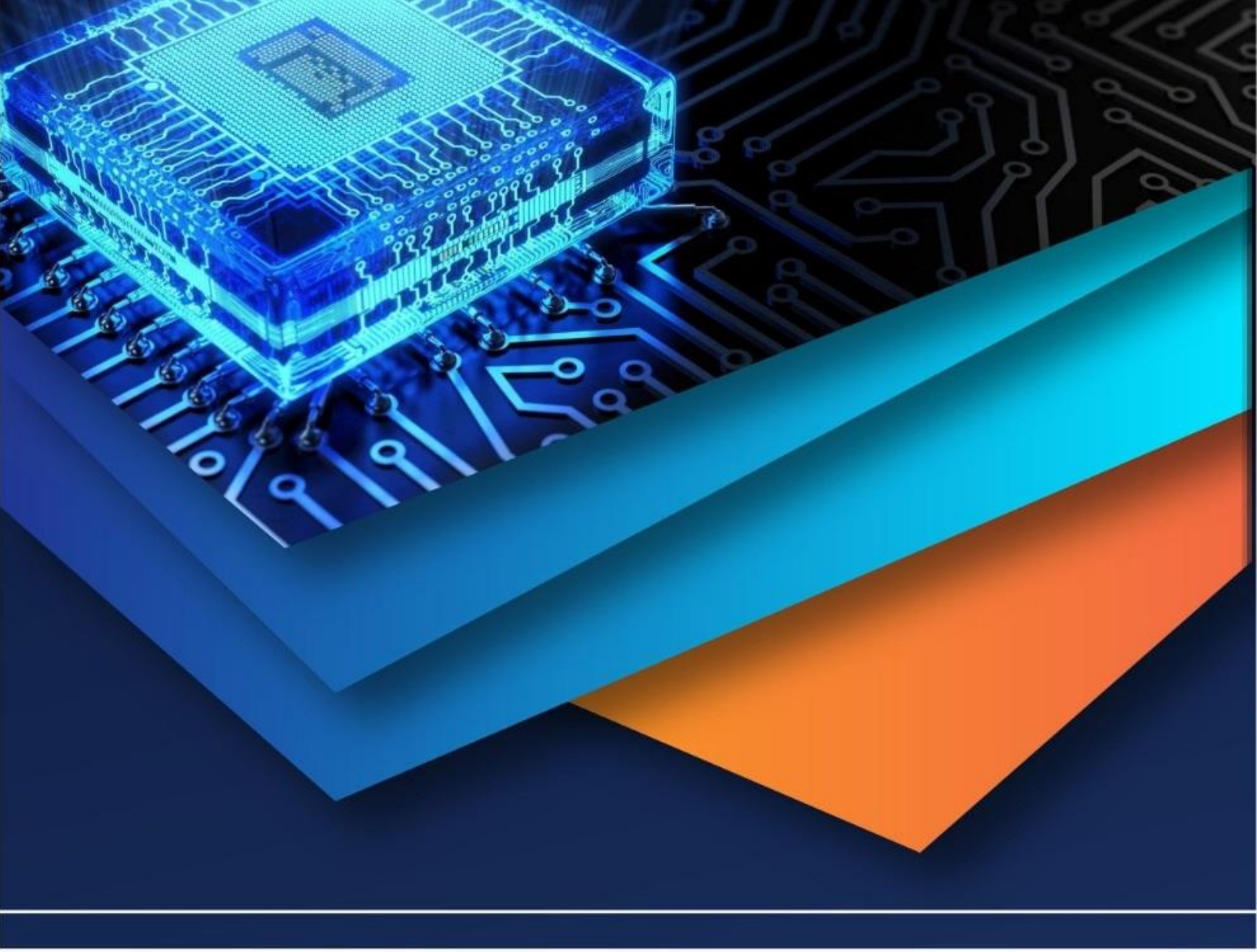
By using the mentioned components we have achieved the final results. User needs to set the temperature according to their convenience. Microcontroller receives the input and the relay is ON. Heat pump heats the water from the water reservoir. This heated water then enters the mattress. Temperature sensor then senses the temperature ate the outlet. If the temperature at the outlet is Ts2<Ts1 then Relay and pump is set ON.

V. CONCLUSION

The main objective of this research was to design and develop rubber mattress for MRI/CT/PET scans. The design and material of the mattress has been approved by a MRI technician. The temperature can also be controlled with the help of mobile phone application or laptop by connecting the microcontroller with Wi-fi. Sensors, fluid pump, heat pump used for the purpose are MRI compatible.

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