

## Design and Implementation of Robot Based Mobile Application for Humidity and Temperature Measurement

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**ABSTRACT:** Recently, robotic based monitoring system framework has seen a fast development as far as innovation established. Temperature and humidity for any real product design is most widely recognized the physical estimation architects. The need to ensure a safer environment, to cut down production losses and monitor certain delicate conditions in which production activities are carried out is very vital within industries in the present age. The objectives of this study are to design a prototype mobile robot to measure the temperature and humidity of an environment, to design an algorithm that could be used to control the robot via mobile using a Bluetooth technology. The design of a prototype mobile robot method in this study elaborates hardware and software implementation. The prototypes of mobile robot functioned significantly to full capacity and displayed the measured temperature and humidity values on a 16x2 LCD screen located in the robot and send a copy to smart phone. The prototype design module defined the temperature and humidity for a specified or particular area corresponding with the movement of robot via Bluetooth when the application scope located in few meters.

**KEYWORDS:** Robot control, temperature and humidity, Bluetooth, SMS.

### 1 INTRODUCTION

Temperature sensor precision mentions to how precisely the temperature of the thermal sensor coordinates the focused on measured environment. The design and configuration perspective for temperature sensor precision is beyond the extent of the study. In particular, temperature sensor exactness is not quite the same as temperature sensor determination. Temperature determination may influence by its exactness if the precision is constrained by the determination. This study clarifies different factors affecting an advanced digital sensor's precision. In spite of the fact that the precision of a temperature sensor is ensured by design and configuration, via description and stringent generation testing, with a specific goal to attain to the best accuracy, the concern of external element is just as critical. The best framework execution relies on upon a many factors including the qualities of the remote diode, PCB format, external noise impact, or decision of sensor arrangement. The impact of these external noise impacts on local and remote thermal sensors' precision is complete in this archive.

### 2 RELATED WORK

Several researchers have developed ways to control useful systems such as temperature systems, using direct sensors wirelessly, resulting from the growing need/drive for flexibility, improved safety, improved standard of living and the promotion of an industrialized environment [1,2]. Arduino technology is growing extensively in developed parts of the world

such as in Europe and America, and is recently being introduced into developing countries. It's growing applicability and ease of re-modification as stated in [3], for those who choose to explore the Arduino component and other ways to use it has led to a growing demand for the device.

With a specific end goal to accomplish a superior quality, accessibility and dependability of estimations, a few methodologies can be produced for enhancing tangible data [4]. Multi sensor frameworks utilize the excess and differing qualities of the data accessible in sensor signals and wire them together for higher quality or dependability. Perceptible data can also be enhanced by utilizing one sensor component, however utilizing different excitations and sufficient signal transforming [5]. These purported changed of sensor information frameworks [6] given by and large significant changes of sensory data permitting a superior consideration and observation of measurement impacts, self-measure, self-approval, etc.

In [7] the term of robot was cited to from the English translation of a fantasy play written in Czechoslovakia around 1921. It took about forty years before the modern technology of industrial robotics began as in stated by the researcher Keramas; today robots have transformed into highly automated mechanical manipulators controlled by computers. A robot is a machine which ranges from simple devices to very complex and intelligent systems, constructed as an assemblage of joined links so that they can be articulated into desired positions by a programmable controller and precision actuators to perform a variety of tasks; as in [7].

Wireless communication entails the transfer of information from one point to another without the use of an electrical conductor line as defined in [8]. It uses electromagnetic waves as its means of communication; the flexibility of this means of information transfer or sharing has made it very common in the modern environment. There are various modes of wireless communication such as: radio communication, microwave communication, visible light and infra-red modes, sonic mode and by electromagnetic induction, as applied in [4] where Ethernet and Bluetooth shields are used and in [9] where infra- red is used.

Abdullah et.al [10], has presented a method to effectively use a Bluetooth controlled mobile robot for temperature measurement. Their design utilizes a: KC-21 Bluetooth module, LM352 temperature sensor, L298 dual full bridge driver, microcontroller unit, motors and a hand phone for the overall control of the robot and for temperature visualization. The control range of the robot is limited to 10metres and the temperature sensor has a measurement range of between -55 to 150 degree Celsius. This robot was made to ensure the safety of medical personnel, fire fighters and many other people engaged in occupations where they have to deal with dangerous temperatures. As specified it could not just be applied to these persons but could also be used in industrial enclosures for a similar purpose. The errors incurred by the temperature sensor were estimated to be 2.356% for human temperature measurement and 0.88% for environmental measurement. They went further to give a complete functional analysis of both the MPLab coding and Java coding used for the robot using flowcharts which helps in quickly understanding the entire mechanism. Finally, the measurement of possible errors and the use of flowchart description go further to show the validity and stability of their proposed circuit which could be convincing enough for any prospective user.

### 3 METHODOLOGY

When analyzing and developing mobile robots, the utmost considerations during the design of the mechanical section such as the physical stability of the robot with respect to its structure, efficient speed controllability, and the ways to minimize the effect of forces opposing the motion of the robot and the ability of the selected components to measure environmental conditions accurately. This robot comes with a new generation sensor (HR202 and LM35) made from macromolecule materials to measure relative humidity and temperature respectively. The features of this robot include: an onboard comparator for digital output, a power indicator LED, an onboard potentiometer for level adjustment, an analog output voltage for measurement. Figure 1 shows a sample of the predefine process on the breadboard for modified humidity reading on LCD. The relative deviation of temperature was calibrated by comparing the sensor output value with the real value from android weather app as shown in figure 2.

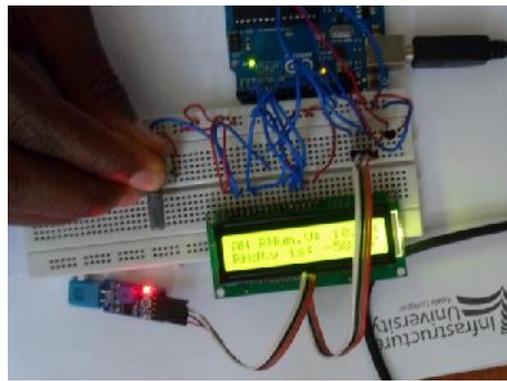


Fig. 1. Modified humidity reading on LCD



Fig. 2. Temperature calibration between android application and Robot temperature sensor

Figure 3 shows the side view of physical robot design and ready for testing using the developed application by the smart phone. The robot will send an SMS alert notification to smart phone for manual or auto control. The robot design also provided the fan status in the interface which will trigger the fan on when situation is hazardous. However the fan status functionality was not developed due to hardware limitation and is recommended for future enhancement.

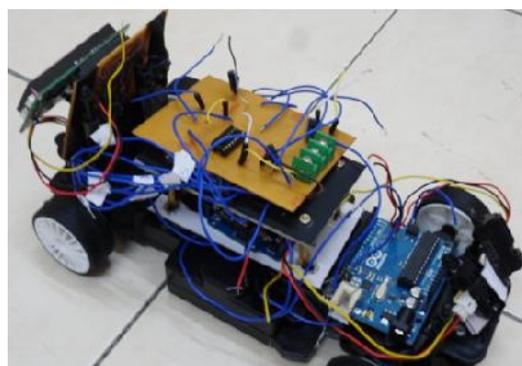


Fig. 3. Modified humidity reading on LCD

### 3.1 MECHANICAL SUBSYSTEM CONCEPT

When analyzing and developing mobile robots, the utmost considerations during the design of the mechanical section are: the physical stability of the robot with respect to its structure, efficient speed controllability, the ways to minimize the effect of forces opposing the motion of the robot and the ability of the selected components to withstand threatening environmental conditions.

#### 3.1.1 STABILITY

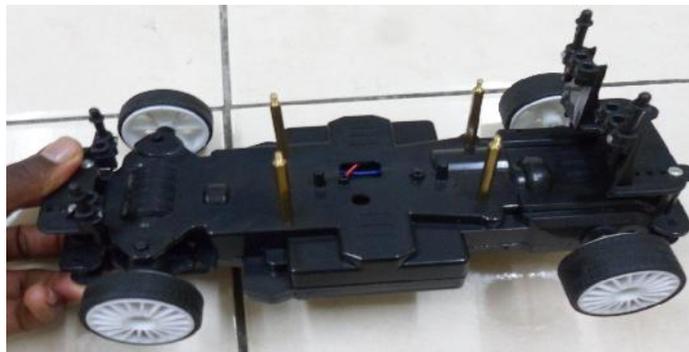
To ensure balance of the mobile robot, a set of tires which would ensure that the base of the robot is close to the ground (has a low center of gravity) will be used in this project.

#### 3.1.2 SPEED CONTROL

The speed control mechanism will comprise distinct but interlinked motor and gear systems as shown in figure 4 below, which are further controlled by the Arduino board through a motor driver using the process of pulse width modulation. The first mechanism controls the fore wheels while the second controls the hind wheels. Figure 5 shows metal support mounted on robot base and overall chassis of the mobile robot.



*Fig. 4. Motor and gear system for the hind wheels*



*Fig. 5. Motor and gear system for the fore wheels*

#### 3.1.3 REDUCTION OF FRICTION

Friction is the tangential reaction force which opposes the motion of two surfaces in contact [11]. It usually occurs in mechanical systems such as: bearings, transmissions, hydraulic and pneumatic cylinders, valves, brakes and wheels. It's highly non-linear and may result in steady state errors, limit cycles and poor performance; hence it is important for control engineers to understand friction phenomena and how to deal with them. In this project grease is used as the lubricants for all the gear systems since the machine in consideration has miniature gear features.

#### 4 RESULTS AND DISCUSSION

The output signals of the IR sensors are programmed to automatically alter the direction of the robot when an obstacle at close range is encountered, whether it's in automatic or controlled mode according to the core movement functions as shown in table 1. Test of the connection between the mobile robot and the smart phone application showed that signals could be sent with in sixteen meters (16m) only in free space area, but the value cut down to about twelve meters (12m) when its operation tested in a cornered area with few obstacles. Figure 4 shows the values of relative humidity from android weather app. and the humidity for robot sensor at a particular time in the day.

Table 1. Core movement functions

Movement	Function
Forward	Front motor stopped while hind motor is driven in forward direction
Backward	Front motor stopped while hind motor is driven in reverse direction
Left	Front motor driven in reverse direction, while hind motor moves in forward direction
Right	Front motor driven in forward direction, while hind motor moves in forward direction
Stop	Both motors stopped

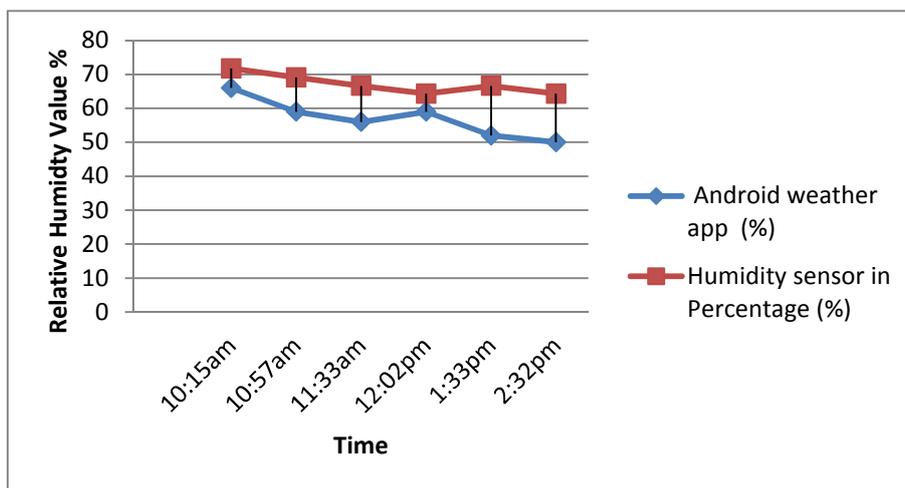


Fig. 6. Modified humidity reading on LCD

#### 5 CONCLUSION

In conclusion, the Bluetooth controlled mobile robot with smart phone was successfully created and all targeted objectives were achieved. With this robot the values of temperature and humidity of a specified or particular area were efficiently measured. The implementation of the various objectives of this study has helped to improve the measuring of various requirements of temperature and humidity when building a system with sensitive development related to humidity and temperature. The measured value by the robot and estimated value from android application were significantly correlated.

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