Module V - PHYSICAL COMPUTING

Learning Objective	Learning Outcome
• To provide hands-on experience of basic coding, using sensors for various activities and getting to work with microcontroller boards	• Would have understood the basics of computers, and learnt how to use basic computer applications for collaboration like presentation, word processing, spreadsheets etc.

About Physical Computing

Physical Computing is building/designing/creating/making interactive systems that use different kinds of software and hardware to sense and respond to an external stimuli – which could be a program, a problem statement, a need, an issue or simply an Idea. In simple words - physical computing is a process where all the input and output devices work together as a single entity on the direction of a brain like object that could be a microcontroller board of a kind.

Physical computing takes a hands-on approach, which means spending a lot of time building circuits, soldering, writing programs, building structures to hold sensors and controls, and figuring out how best to make all of these things talk to each other and give the desired output. Smart automotive traffic control systems, factory automation processes, washing machines, fitness equipment found in homes, offices and industry – these are all things that make use of physical computing.

In essence, this is the stage where all that we have learnt in the previous module will be used and put together to finally reach the objective of making a prototype and/or working project.

By now, you would have gone through the process of:

- Design thinking - generated ideas - identified problems - used flowcharts/algorithms to depict the problems etc.

And understood about the following:

- Sensors
- Circuits

Now let's put it all together and start creating/making!

Note for the facilitator

The following presentations will take you through the process:

- Please refer to the following presentations and activity cards provided in the pen drive
  - Presentation - Physical Computing – Let's get to know boards - will give you an overview of different types of boards
  - Presentation - Physical Computing – Getting Started Guide Part 1 - will take you through the process of programming a board
  - Presentation - Physical Computing – Getting Started Guide Part 2 - a mini book for learning to program a board with simple DIY activities
  - Presentation - Physical Computing – Getting Started Guide Part 3 - will take you through the process of connecting sensors with board
  - Activity cards 1 – 5 - each of the activity card will give an understanding of how to work with a different set of sensors - LDR, Flex, Water Level, Soil Moisture, MQ Gas Sensors; each has a step-by-step process to follow and get the desired output
- Please ensure all the participants/students solve the exercises given at the end of the presentation.

To take you further in your journey to become an innovator, listed below are five sample activities that are completely DIY. It's time to be completely on your own and make something. These activities should be able to help you to do just this.

List of five completely DIY activities

Activities	Key Objective of the Activity
Alcohol Test	Check the consumption of alcohol amongst drivers to avoid accidents
Earthquake Test	Create a monitoring system to detect the chances of earthquakes in the near future
Heart Monitor Test	Measure heartbeat using a pulse sensor and Genuino 101*
Smart Irrigation Pump Test	Create a smart irrigation pump that can be controlled using a mobile app
Water Quality Test	Detect water quality to make sure people drink clean water

Resources

To get some more inspiration, you may refer to the following:

Brief Description	Resource URL
Physical Computing	https://www.youtube.com/watch?v=TAlsEZEcSis https://www.youtube.com/watch?v=8npwSASQqyk
Arduino Getting Started	https://www.youtube.com/watch?v=grU7eNPBRxk&list=PLT6rF_I5knPf2qlVFlvH47qHvqvzkknd&index=1
More about Arduino	Why Arduino? (Ted Talk by Arduino Founder) https://www.ted.com/talks/massimo_banzi_how_arduino_is_open_sourcing_imagination Anatomy of an Arduino Board https://www.arduino.cc/en/Guide/BoardAnatomy Arduino IDE https://www.arduino.cc/en/Guide/Environment Arduino Tutorials Playlist (Very useful for beginners , Highly Recommended) https://www.youtube.com/playlist?list=PLA567CE235D39FA84 What all we can do with Arduino? https://www.youtube.com/watch?v=grU7eNPBRxk&list=PLT6rF_I5knPf2qlVFlvH47qHvqvzkknd&index=1 Arduino Basic Hardware Overview and Fundamental Code Commands https://www.youtube.com/watch?v=BtLwoNJ6klE Programming Raspberry Pi https://www.youtube.com/watch?v=eObSqbe9aqU
Physical Computing into Wearable tech - story	https://www.youtube.com/watch?v=LwOLbbPcduM&t=10s
Learn about switches	Push Buttons for Arduino https://www.youtube.com/watch?v=1C-3P_hmd70
Using Motor Driver Shields with Arduino	L298N using Motors with Arduino https://www.youtube.com/watch?v=nZdrWQcpb9E Stepper Motor with Arduino using L293D https://www.youtube.com/watch?v=nZdrWQcpb9E
How servo Motor works	https://www.youtube.com/watch?v=gviUtLsHDtg
Learn about soldering iron	How to Solder basics https://www.youtube.com/watch?v=BxeDkcAa4Fs Common Soldering Mistakes | Soldering https://www.youtube.com/watch?v=igqkhkff6cw http://www.dummies.com/programming/electronics/what-is-soldering-and-how-do-you-use-solder-tools/

Tutorials showing usage of different types of sensors with Arduino Boards	Gas sensors with Arduino https://www.youtube.com/watch?v=BIf_mpnsZvY Smoke and Gas Sensors https://www.youtube.com/watch?v=YgEOnZ-7i8o Calibrating with MQ2 Gas Sensors https://www.youtube.com/watch?v=YgEOnZ-7i8o Thermistor for Temperature Sensing https://www.youtube.com/watch?v=9opuvLXAetI Force Sensor with Arduino https://www.youtube.com/watch?v=1p8AE_QA8qQ Barometric Pressure Sensor with Arduino https://www.youtube.com/watch?v=s8e1eEqktm4 Ultrasonic Sensors (Very Interesting Project , It explains how radar works) https://www.youtube.com/watch?v=kQRYIH2HwfY GPS with Arduino https://www.youtube.com/watch?v=dy2iygCZTIM
Get inspired with series of ideas of DIY	http://www.instructables.com/tag/type-id/category-technology/channel-arduino/